Biographical Sketch
Michael (Mykhailo) Shatruk

Place of Birth: Lviv, Ukraine
Citizenship: USA

Florida State University | Department of Chemistry & Biochemistry
Phone: (850) 417-8417, E-mail: shatruk@chem.fsu.edu
http://www.chem.fsu.edu/~shatruk/

Professional Preparation

Lomonosov Moscow State University		Chemistry	B.S./M.S., 1996
Lomonosov Moscow State University		Chemistry	Ph.D., 2000
Cornell University	Ithaca, NY	Materials Chemistry	Postdoc, 2001-2003
Texas A&M University	College Station, TX	Inorganic Chemistry	Postdoc, 2003-2007

Appointments

Florida State University	Cottrell Family Professor	2018-current
Florida State University	Professor	2016-current
University of Valencia	Visiting Professor	2016
Florida State University	Associate Professor	2013-2016
Florida State University	Associate Chair for Graduate Studies	2012-2015
Florida State University	Assistant Professor	2007-2013

Honors, Awards, and Prizes

Graduate Faculty Mentor Award, Florida State University (2021).
Recognition for Service, Division of Inorganic Chemistry, American Chemical Society (2020).
Cottrell Family Professorship, Florida State University (2018-2021).
Nominated for Distinguished Teaching Award, Florida State University (2018, 2020).
Nominated for Undergraduate Teaching Award, Florida State University (2017).
Graduate Faculty Mentor Award, Florida State University (2015).
Nominated for Undergraduate Teaching Award, Florida State University (2014).
Developing Scholar Award, Florida State University (2014).
ExxonMobil Faculty Fellowship in Solid State Chemistry, American Chemical Society (2012).
Graduate Teaching Award, Florida State University (2011).
Nominated for Undergraduate Teaching Award, Florida State University (2011).
CAREER Award, National Science Foundation; Division of Materials Research (2009).
First-Year Assistant Professor Award, Florida State University (2008).
Best Publication Series, International Publishing Company "Nauka/Interperiodics" (2001).
Best Young Scientist Award, Department of Chemistry, Moscow State University (1999).

Funded External Grants

Current Funding

1. Magnetic Phase Boundary Mapping for the Discovery of Emergent Properties in Intermetallic Magnets
   NSF-DMR, $503,478, 2/1/2023-1/31/2026.
2. Energy Frontier Research Center: Molecules to Quantum Materials (M2QM)
   (co-PI with subcontract from UF); DOE-BES, $400,000 (co-PI's share), 8/1/2022-7/31/2026.
3. MRI: Acquisition of a Versatile Magnetic Property Measurement System (PI – Shatruk; co-PIs – Latturner, Strouse, Thirunavukkuarasu, Xiong); NSF-DMR, $385,483, 9/1/2022-8/31/2025.
4. Spin-State Switching and Conductivity in Metal Complexes with Non-Innocent Ligands
   (PI – Shatruk; co-PI – Hill); NSF-CHE, $500,245, 5/1/2020-4/30/2023.
5. Probing Effects of Pressure, Mixed Valence, and Spin Frustration on Itinerant Magnets
   NSF-DMR, $488,287, 8/15/2019-4/30/2023.
6. ACS Bridge Site for Transitional Master's Program at Florida State University
   (PI – Shatruk; co-PI – DePrince); ACS-Genentech, $180,000, 5/1/2021-4/30/2024.

Past Funding

7. REU Site: Sunshine Institute for the Interaction of Light with Matter (PI – Hilinski; co-PI – Shatruk); NSF-CHE, $315,000, 5/1/2017-4/30/2023.
8. MRI: Acquisition of a Dual-Source Single-Crystal X-ray Diffractometer (PI – Shatruk; co-PIs – Alabugin, Frederich, Latturner, Ma); NSF-CHE, $272,300, 8/15/2018-7/31/2021.
9. Discovery of New Petroleum Reforming Catalysts via Investigation of Complex Metallic Alloys Aided by Deep Learning Methods; ACS-PRF, $110,000, 8/1/2018-8/31/2020.
10. Light-Induced Magnetic Switching as a Trigger for Phase Transitions in Molecular Materials (PI – Shatruk; co-PI – Dalal); NSF-CHE, $477,169, 7/1/2015-4/30/2019.
11. Investigation Of Strongly Correlated Itinerant Magnets And Spin-Frustrated Systems NSF-DMR, $405,000; 6/1/2015-11/30/2018.
12. MRI-Acquisition of a Transient Absorption Spectrometer (PI – Hanson; co-PIs – Shatruk, Albrecht-Schmitt, Strouse); NSF-CHE, $206,847, 6/1/2015-5/31/2018.
13. Investigation Of Magnetocaloric Properties In Materials Derived From $AlFe_2B_2$ BASF Corporation; $300,083; 3/1/2015-12/31/2017.
14. Smoke Obscuration Technology / Programmable Molecular Transformations (PI – Shatruk; co-PI – Locke); DOTC-Chemring, $987,824, 12/1/2013-6/30/2016.
15. Computational/Combinatorial Discovery of New Intermetallics; DOE-ORNL, $120,000, 5/21/2013-8/7/2016.
16. CAREER: Magnetostructural correlations in rare earth – transition metal pnictides and tetrelides NSF-DMR, $511,824, 5/1/2010-4/30/2015.
17. Polymer-Embedded Gamma-Ray Detectors (PI – Shatruk; co-PIs – DePrince, Hanson, Schlenoff) DARPA-Invincea, $95,664, 5/9/2014-8/7/2014.
18. Hybrid Fe(II) spin crossover materials: Organic conductors, small molecule sensors, and functionalized nanoparticles; NSF-CHE, $382,000, 9/1/2009-8/31/2013.

Synergistic Activities

- **Leadership:** FSU core university liaison to Oak Ridge National Laboratory (ORNL). Responsibilities: facilitating interactions and collaboration between the FSU and ORNL scientists, informing FSU faculty and students of collaboration and funding opportunities offered by various ORNL programs.
- **Professional Service:** Awards committee co-chair, Division of Inorganic Chemistry, American Chemical Society (January 2016 – December 2020). Responsibilities: advertising the awards offered by the division; processing and ranking applications and nominations; award symposia organization.
- **Broadening Participation:** Providing research training to 6-7 FSU undergraduate students and 2 high-school teachers (NSF-RET participants) each year; running an outreach Materials Innovation and Discovery Lab (MINDLab) for high-school students.
- **Conference Organization:** Organizer of the symposium “Magnetism Across Length Scales” at the ACS National Meeting (April 2019) and co-chair of the Gordon Research Conference on Conductivity and Magnetism in Molecular Materials in Bryant University (August 2018).
- **Guest Editor:** A special issue of Dalton Transactions, *Frontiers in Coordination Chemistry and Its Applications* (August 2018).
- **Editorial Board Member:** ACS Materials Au, Polyhedron, Magnetochemistry

PUBLICATIONS

SUBMITTED

1. Yazback, M.; Liu, S.; Wang, P.; Shatruk, M.; Christou, G.; Cheng, H. P. Search for toroidal ground state and magnetoelectric effects in molecular spin triangles with antiferromagnetic exchange. *J. Phys. Chem. C* Under review.
2. Savvidou, A. F.; Ptok, A.; Sharma, G.; Casas, B.; Clark, J. K.; Li, V. M.; Shatruk, M.; Tewari, S.; Balicas, L. Anisotropic positive linear and sub-linear magnetoresistivity in the cubic type-II Dirac metal Pd_3In_7. *Nat. Commun.* Under review.
3. Gamage, E. H.; Kamali, S.; Clark, J. K.; Yox, P.; Shatruk, M.; Kovnir K. Inducing ferromagnetic exchange in 1D-$FeSe_2$ chains using heteroleptic amine complexes: $[Fe(en)(tren)][FeSe_2]_2$. *Inorg. Chem. Front.* Under revision.
4. Lewkowitz, M.; Adams, J.; Sullivan, N. S.; Wang, P.; Shatruk, M.; Zapf, V.; Arvij, A. S. Direct observation of electric field-induced magnetism in a molecular magnet. *Sci. Rep.* Under revision.
5. Wang, P.; Lin, X.; Bisht, S.; Gakiya-Teruya, M.; Yergeshbayeva, S.; Shatruk, M. Structural and magnetic investigation of Co^{II} valence tautomeric complexes with sulfur-containing ligands. *Cryst. Growth Des.* Under revision.

IN PRESS

6. Kovel, C. B.; Darmon, J. M.; Stieber, S. C. E.; Pombar, G.; Pabst, T. P.; Theis, B.; Turner, Z.; Üngör, Ö.; Shatruk, M.; DeBeer, S.; Chirik, P. J. Bimolecular reductive elimination of ethane from pyridine(diimine) iron methyl complexes: mechanism, electronic structure, and entry into [2+2] cycloaddition catalysis. *J. Am. Chem. Soc.* **2023**, In press.
7. Mishra, E.; Ekanayaka, T. K.; Panagiotakopoulos, T.; Le, D.; Rahman, T. S.; Wang, P.; McElveen, K. A.; Phillips, J. P.; Zaid Zaz, Md.; Yazdani, S.; NDiaye, A. T.; Lai, R. Y.; Streubel, R.; Cheng, R.; Shatruk, M.; Dowben, P. A. Electronic structure of cobalt spin-crossover molecules in different environments. *Nanoscale* **2023**, In press.
8. Zhou, Z.; Wei, Z.; Yao, X.; Wang, X. Y.; Müllen, K.; Jo, M.; Shatruk, M.; Petrukhina, M. A. Triply-reduced hexa-peri-hexabenzocoronenes: solid-state structures and magnetic properties. *Cryst. Growth Des.* **2023**, In press.
9. Shatruk, M.; Clark, J. K. Magnetic materials. In *Comprehensive Inorganic Chemistry III,* Reedijk, J.; Poeppelmeier, K. R., Eds.; Elsevier, **2023**, In press.

PUBLISHED

10. Ekanayaka, T. K.; Üngör, Ö.; Hu, Y.; Mishra, E.; Phillips, J. P.; Dale, A. S.; Yazdani, S.; Wang, P.; Zhang, J.; N'Diaye, A. T.; Klewe, C.; Shafer, P.; Streubel, R.; Cheng, R.; Shatruk, M.; Dowben, P. A. Perturbing the spin state and conduction of Fe(II) spin crossover complexes with TCNQ. *Mater. Chem. Phys.* **2023**, *296*, 127276.
11. Sasi Kumar, G.; Xin, Y.; Vellore Winfred, R. J. S.; Clark, J. K.; Shatruk, M. 2D spin glass $MnIn_2Se_4$: application of liquid-phase exfoliation to a layered structure with seven-atom-thick layers. *J. Mater. Chem. C* **2023**, *11*, 609-615.
12. Kuriakose, F.; Commodore, M.; Fabiano, C. J.; Sen, D.; Li, R. R.; Hu, C.; Bisht, S.; Üngör, Ö.; Lin, X.; Strouse, G. F.; DePrince III, A. E.; Lazenby, R. A.; Mentink-Vigier, F.; Shatruk, M.; Alabugin, I. V. Design and synthesis of Kekulè and non-Kekulè diradicaloids via radical peri-annulation strategy: the power of seven Clar's sextets. *J. Am. Chem. Soc.* **2022**, *144*, 23448-23464.
13. Koptur-Palenchar, J.; Gakiya-Teruya, M.; Le, D.; Jiang, J.; Zhang, R.; Watanabe, K.; Taniguchi, T.; Cheng, H. P.; Rahman, T. S.; Shatruk, M.; Zhang, X. X. Two-dimensional spin bistable molecules by mechanical exfoliation. *npj 2D Mater. Appl.* **2022**, *6*, 59.
14. Yergeshbayeva, S.; Hrudka, J.; Jo, M.; Gakiya-Teruya, M.; Meisel, M.; Shatruk, M. Abrupt spin transition in a heteroleptic Fe(II) complex with pendant naphthalene functionality. *Inorg. Chem.* **2022**, *61*, 11349-11358.
15. Gamage, E. H.; Kamali, S.; Clark, J. K.; Lee, Y.; Yox, P.; Shafer, P.; Yaroslavtsev, A. A.; Ke, L.; Shatruk, M.; Kovnir, K. As-Se pentagonal linkers to induce chirality and polarity in mixed-valent Fe-Se tetrahedral

chains resulting in hidden magnetic ordering. *J. Am. Chem. Soc.* **2022**, *144*, 11283-11295.

16. Xu, J.; Kolenko, Y.; Mann, D. K.; Shatruk, M. Electrode material. *U.S. Pat. Appl. Publ.* **2022**, US 20220056600A1.
17. Mann, D. K.; Díez, A. M.; Xu, J.; Lebedev, O. I.; Kolen'ko, Y. V.; Shatruk, M. Polar layered intermetallic $LaCo_2P_2$ as water oxidation electrocatalyst. *ACS Appl. Mater. Interfaces* **2022**, *14*, 14120-14128.
18. Tener, Z. P.; Yannello, V.; Garlea, V. O.; Lapidus, S. H.; Yox, P.; Kovnir, K.; Stoian, S. A.; Shatruk, M. Evolution of bonding and magnetism *via* changes in valence electron count in $CuFe_{2-x}Co_xGe_2$. *Inorg. Chem.* **2022**, *61*, 4257-4269.
19. Ekanayaka, T. K.; Wang, P.; Yazdani, S.; Phillip, J. P.; Mishra, E.; Dale, A. S.; N'Diaye, A. T.; Klewe, C.; Shafer, P.; Freeland, J.; Streubel, R.; Wampler, J. P.; Zapf, V.; Cheng, R.; Shatruk, M.; Dowben, P. A. Evidence of dynamical effects and critical field in a cobalt spin crossover complex. *Chem. Commun.* **2022**, *58*, 661-664.
20. Gamage, E. H.; Clark, J. K.; Yazback, M.; Cheng, H. P.; Shatruk, M.; Kovnir, K. Solvothermal synthesis of $[Cr_7S_8(en)_8Cl_2]Cl_3\cdot 2H_2O$ with magnetically frustrated $[Cr_7S_8]^{5+}$ double-cubes. *Chem. Eur. J.* **2022**, *28*, e202103761.
21. Saucedo, L. A.; Clark, J. K.; Vellore Winfred, J. S. R.; Strouse, G. F.; Shatruk, M. Increasing magnetic hardness of Fe_3Se_4 via Cu doping. *J. Phys. Chem. C* **2021**, *125*, 25784-25793.
22. Üngör, Ö.; Choi, E. S.; Shatruk, M. Solvent-dependent spin-crossover behavior in semiconducting co-crystals of $[Fe(1\text{-}bpp)_2]^{2+}$ cations and $TCNQ^{\delta-}$ anions ($0 < \delta < 1$). *Eur. J. Inorg. Chem.* **2021**, 4812-4820.
23. Üngör, Ö.; Igimbayeva, D.; Dragulescu-Andrasi, A.; Yergeshbayeva, S.; Delgado, T.; Greer, S. M.; Donalson, G.; Jo, M.; Erkasov, R.; Shatruk, M. Pyridyl-thioethers as capping ligands for the design of heteroleptic Fe(II) complexes with spin-crossover behavior. *Magnetochemistry* **2021**, *7*, 134.
24. Zhou, Z.; Üngör, Ö.; Wei, Z.; Shatruk, M.; Tsybizova, A.; Gershoni-Poranne, R.; Petrukhina, M. A. Tuning magnetic interactions between triphenylene radicals by variation of crystal packing in structures with alkali metal counterions. *Inorg. Chem.* **2021**, *60*, 14844-14853.
25. Macy, J.; Ratkovski, D.; Balakrishnan, P. P.; Strungaru, M.; Chiu, Y. C.; Savvidou, A. F.; Moon, A.; Zheng, W.; Weiland, A.; McCandless, G. T.; Chan, J. Y.; Kumar, G. S.; Shatruk, M.; Grutter, A. J.; Borchers, J. A.; Ratcliff, W. D.; Choi, E. S.; Santos, E.; Balicas, L. Magnetic field-induced non-trivial electronic topology in Fe_3GeTe_2. *Appl. Phys. Rev.* **2021**, *8*, 041401.
26. Gakiya-Teruya, M.; Jiang, X.; Le, D.; Üngör, Ö.; Durrani, A. J.; Koptur-Palenchar, J.; Jiang, J.; Jiang, T.; Meisel, M. W.; Cheng, H. P.; Zhang, X. G.; Zhang, X. X.; Rahman, T. S.; Hebard, A. F.; Shatruk, M. Asymmetric design of spin-crossover complexes to increase the volatility for surface deposition. *J. Am. Chem. Soc.* **2021**, *143*, 14563-14572.
27. Üngör, Ö.; Choi, E. S.; Shatruk, M. Optimization of crystal packing in semiconducting spin-crossover materials with fractionally charged $TCNQ^{\delta-}$ anions ($0 < \delta < 1$). *Chem. Sci.* **2021**, *12,* 10765-10779.
28. Clark, J. K.; Yannello, V.; Samarakoon, A. M.; Ross, C.; Uible, M. C.; Garlea, V. O.; Shatruk, M. Inelastic neutron scattering study of magnetic exchange pathways in MnS. *J. Phys. Chem. C* **2021**, *125*, 16183-16190.
29. Üngör, Ö; Burrows, M.; Liu, T.; Bodensteiner, M.; Adhikari, Y.; Hua, Z.; Casas, B.; Balicas, L.; Xiong, P.; Shatruk, M. Paramagnetic molecular semiconductors combining anisotropic magnetic ions with TCNQ radical anions. *Inorg. Chem.* **2021**, *60*, 10502-10512.
30. Le, D.; Gakiya-Teruya, M.; Shatruk, M.; Rahman, T. S. On stabilizing spin crossover molecule $[Fe(tBu_2qsal)_2]$ on suitable supports: insights from ab initio studies. *J. Phys. Condens. Matter* **2021**, *33*, 385201.
31. Sharma, S.; Kovalev, A. E.; Rebar, D. J.; Mann, D.; Yannello, V.; Shatruk, M.; Suslov, A. V.; Smith, J. H.; Siegrist, T. Magnetostriction of $AlFe_2B_2$ in high magnetic fields. *Phys. Rev. Mater.* **2021**, *5*, 064409.
32. Clark, J. K.; Pak, C.; Cao, H.; Shatruk, M. Helimagnetism in $MnBi_2Se_4$ driven by spin-frustrating interactions between antiferromagnetic chains. *Crystals* **2021**, *11*, 242.
33. Tener, Z. P.; Yannello, V.; Willis, J.; Garlea, V. O.; Shatruk, M. Magnetization distribution in $Cu_{0.6}Mn_{2.4}Ge_2$ ferromagnet from polarized and non-polarized neutron powder diffraction aided by density-functional theory calculations. *J. Magn. Magn. Mater.* **2021**, *529*, 167827.

34. Savvidou, A. F.; Clark, J.; Wang, H.; Wei, K.; Choi, E. S.; Mozaffari, S.; Qian, X.; Shatruk, M.; Balicas, L. Complex Dirac-like electronic structure in atomic side ordered $Rh_3In_{3.4}Ge_{3.6}$. *Chem. Mater.* **2021**, *33*, 1218-1227.
35. Romanini, M.; Wang, Y.; Gürpinar, K.; Ornelas, G.; Lloveras, P.; Zhang, Y.; Zheng, W.; Barrio, M.; Aznar, A.; Gràcia-Condal, A.; Emre, B.; Popescu, C.; Zhang, H.; Long, Y.; Balicas, L.; Tamarit, J. L.; Planes, A.; Shatruk, M.; Mañosa, L. Giant and reversible barocaloric effect in trinuclear spin-crossover complex $Fe_3(bntrz)_6(tcnset)_6$. *Adv. Mater.* **2021**, *33*, 2008076.
36. Jones, T. M.; Botcha, N. K.; Yergeshbayeva, S.; Shatruk, M.; Mukherjee, A. Investigating reactivity and electronic structure of Cu(II)-polypyridyl complexes and hydrogen peroxide. *Inorg. Chim. Acta* **2021**, *516*, 120168.
37. Serov, A.; Kovnir, K.; Shatruk, M.; Kolen'ko, Y. V. Critical review of earth-abundant borides and phosphides for water electrolysis: transition from the lab to the market. *Johnson Matthey Technol. Rev.* **2021**, *65*, 207-226.
38. Jo, M.; Li, J.; Dragulescu-Andrasi, A.; Rogachev, A. Yu.; Shatruk, M. Incorporation of coinage metal-NHC complexes into heptaphosphide clusters. *Dalton Trans.* **2020**, *49*, 12955-12959.
39. Gamage, E. H.; Greenfield, J. T.; Unger, C.; Kamali, S.; Clark, J. K.; Harmer, C.; Luo, L.; Wang, J.; Shatruk, M.; Kovnir, K. Tuning Fe-Se tetrahedral frameworks by a combination of $[Fe(en)_3]^{2+}$ cations and Cl^- anions. *Inorg. Chem.* **2020**, *59*, 13353-13363.
40. Mann, D. K.; Wang, Y. X.; Marks, J. D.; Strouse, G. F.; Shatruk, M. Microwave synthesis and magnetocaloric effect in $AlFe_2B_2$. *Inorg. Chem.* **2020**, *59*, 12625-12631.
41. Nauman, M.; Alnasir, H.; Hamayun, M.; Wang, Y.; Shatruk, M.; Manzoor, S. Size-dependent magnetic and magnetothermal properties of gadolinium silicide nanoparticles. *RSC Adv.* **2020**, *10*, 28383-28389.
42. Wang, Y. X.; Yannello, V.; Graterol, J.; Zhang, H.; Long, Y.; Shatruk, M. Theoretical and experimental insights into effects of Zn doping on magnetic and magnetocaloric properties of MnCoGe. *Chem. Mater.* **2020**, *32*, 6721-6729.
43. Clark, J. K.; Tan, X.; Arico, A. A.; Ramirez, A. P.; Yannello, V.; Thompson, C. M.; Kovnir, K.; Garlea, O. V.; Shatruk, M. Reentrant spin glass state induced by structural phase transition in $La_{0.4}Ce_{0.6}Co_2P_2$. *Phys. Rev. Mater.* **2020**, *4*, 074412.
44. Oey, Y. M.; Bocarsly, J. D.; Levin, E. E.; Mann, D.; Shatruk, M.; Seshadri, R. Structural changes upon magnetic ordering in magnetocaloric $AlFe_2B_2$. *Appl. Phys. Lett.* **2020**, *116*, 212403.
45. Jo, M.; Dragulescu-Andrasi, A.; Miller, L. Z.; Pak, C.; Shatruk, M. Nucleophilic activation of red phosphorus for controlled synthesis of polyphosphides. *Inorg. Chem.* **2020**, *59*, 5483-5489.
46. Üngör, Ö.; Shatruk, M. Transition metal complexes with fractionally charged TCNQ radical anions as structural templates for multifunctional molecular conductors. *Polyhedron* **2020**, *177*, 114254.
47. Zhou, Z.; Kawade, R. K.; Wei, Z.; Kuriakose, F.; Üngör, Ö.; Jo, M.; Shatruk, M.; Gershoni-Poranne, R.; Petrukhina, M. A.; Alabugin, I. Negative charge as a lens for concentrating antiaromaticity: using pentagonal "defect" and helicene strain for cyclizations. *Angew. Chem. Int. Ed.* **2020**, *59*, 1256-1262.
48. Üngör, Ö.; Phan, H.; Choi, E. S.; Roth, J. K.; Shatruk, M. Magnetism and electrical conductivity of molecular semiconductor, $[Fe^{II}(DMF)_4(TCNQ)_2](TCNQ)_2$, with fractionally charged TCNQ units. *J. Magn. Magn. Mater.* **2020**, *497*, 165984.
49. Dragulescu-Andrasi, A.; Filatov, A.; Oakley, R. T.; Li, X.; Lekin, K.; Huq, A.; Pak, C.; Greer, S. M.; McKay, J.; Jo, M.; Lengyel, J.; Hung, I.; Maradzike, E.; DePrince, A. E.; Stoian, S. A.; Hill, S.; Hu, Y. Y.; Shatruk, M. Radical dimerization in plastic organic crystal leads to structural and magnetic bistability with wide thermal hysteresis. *J. Am. Chem. Soc.* **2019**, *141*, 17989-17994.
50. Lengyel, J.; Wang, X.; Choi, E. S.; Besara, T.; Schönemann, R. U.; Ramakrishna, S. K.; Holleman, J.; Blockmon, A. L.; Hughey, K. D.; Beery, D.; Balicas, L.; McGill, S.; Hanson, K.; Musfeldt, J.; Siegrist, T.; Dalal, N.; Shatruk, M. Antiferroelectric phase transition in a proton-transfer salt of squaric acid and 2,3-dimethylpyrazine. *J. Am. Chem. Soc.* **2019**, *141*, 16279-16287.
51. Shatruk, M.; McQuade, D. T.; Dragulescu-Andrasi, A.; Miller, L. Z.; Pak, C. Method of conversion of red phosphorous to soluble polyphosphides. *U.S. Pat. Appl. Publ.* **2019**, US 10167196 B1 20190101.
52. Shatruk, M. Synthesis of phosphides. In *Fundamentals and Applications of Phosphorous*

Nanomaterials, Ji, H., Ed.; ACS Symposium series, American Chemical Society: Washington, DC, **2019**, Chapter 6, p. 103-134.

53. Zhou, C.; Lin, H.; Neu, J.; Zhou, Y.; Chaaban, M.; Lee, S.; Worku, M.; Chen, B.; Clark, R.; Cheng, W.; Guan, J.; Djurovich, P.; Zhang, D.; Lü, X.; Bullock, J.; Pak, C.; Shatruk, M.; Du, M. H.; Siegrist, T.; Ma, B. Green emitting single-crystalline bulk assembly of metal halide clusters with near-unity photoluminescence quantum efficiency *ACS Energy Lett.* **2019**, *4*, 1579-1583.
54. Dragulescu-Andrasi, A.; Hietsoi, O.; Üngör, Ö.; Dunk, P. W.; Stubbs, V.; Arroyave, A.; Kovnir, K.; Shatruk, M. Dicyanometalates as building blocks for multinuclear Fe(II) spin-crossover complexes. *Inorg. Chem.* **2019**, *58*, 11920-11926.
55. Pak, C.; Garlea, V. O.; Yannello, V.; Cao, H.; Bangura, A. F.; Shatruk, M. $Na_2Mn_3Se_4$: strongly frustrated antiferromagnetic semiconductor with complex magnetic structure. *Inorg. Chem.* **2019**, *58*, 5799-5806.
56. Shatruk, M. $ThCr_2Si_2$ structure type: the "perovskite" of intermetallics. *J. Solid State Chem.* **2019**, *272*, 198-209.
57. Yannello, V.; Guillou, F.; Yaroslavtsev, A. A.; Tener, Z. P.; Wilhelm, F.; Yaresko, A. N.; Molodtsov, S. L.; Scherz, A.; Rogalev, A.; Shatruk, M. Revisiting bond breaking and making in $EuCo_2P_2$: where are the electrons? *Chem. Eur. J.* **2019**, *25*, 5865-5869.
58. Mann, D.; Xu, J.; Mordvinova, N.; Yannello, V.; Ziouani, Y.; González-Ballesteros, N.; Sousa, J.; Lebedev, O.; Kolen'ko, Y.; Shatruk, M. Electrocatalytic water oxidation over $AlFe_2B_2$. *Chem. Sci.* **2019**, *10*, 2796-2804.
59. Han, H.; Wei, Z.; Filatov, A. S.; Carozza, J. C.; Alkan, M.; Rogachev, A. Yu.; Shevtsov, A.; Abakumov, A. M.; Pak, C.; Shatruk, M.; Chen, Y. S.; Dikarev, E. V. Three to tango requires a site-specific substitution: heterotrimetallic molecular precursors for high-voltage rechargeable batteries. *Chem. Sci.* **2019**, *10*, 524-534.
60. Jo, M.; Rivalti, D.; Ehle, A. R.; Dragulescu-Andrasi, A.; Hartweg, M.; Shatruk, M.; McQuade, D. T. Understanding six-nembered NHC-copper(I) allylic borylation selectivity by comparison with other catalysts and different substrates. *Synlett* **2018**, *29*, 2673-2678.
61. Ryan, K.; Lengyel, J.; Shatruk, M. Crystal structure prediction via deep learning. *J. Am. Chem. Soc.* **2018**, *140*, 10158-10168.
62. Greer, S. M.; Oakley, R. T.; van Tol, J.; Shatruk, M.; Hill, S. Investigating the thermally- and light-induced interconversion of bisdithiazolyl radicals and dimers with high-field EPR. *Polyhedron* **2018**, *153*, 99-103.
63. Lengyel, J.; Stoian, S. A.; Dalal, N.; Shatruk, M. Directed synthesis and magnetic properties of a hexanuclear ferric cluster. *Polyhedron* **2018**, *151*, 446-461.
64. Hrudka, J. J.; Phan, H.; Jengyel, J.; Rogachev, A. Yu.; Shatruk, M. Power of three: incremental increase in the ligand field strength of *N*-alkylated 2,2′-biimidazoles leads to spin crossover in homoleptic tris-chelated Fe(II) complexes. *Inorg. Chem.* **2018**, *57*, 5183-5193.
65. Tener, Z.; Abramchuk, M.; Tan. X.; Shatruk, M.; Misra, S.; Barrera-Medrano, D. Magnetocaloric regenerators comprising materials containing cobalt, manganese, boron and carbon. *PCT Int. Appl.* **2018**, WO 2018011189 A1 20180118.
66. Tan, X.; Tener, Z. P.; Shatruk, M. Correlating itinerant magnetism in RCo_2Pn_2 pnictides (R = La, Ce, Pr, Nd, Ca; Pn = P, As) to their crystal and electronic structures. *Acc. Chem. Res.* **2018**, *51*, 230-239.
67. Zhou, C.; Lin, H.; Shi, H.; Tian, Y.; Pak, C.; Shatruk, M.; Zhou, Y.; Djurovich, P.; Du, M.; Ma, B. A zero-dimensional organic seesaw-shaped tin bromide with highly efficient strongly Stokes-shifted deep-red emission. *Angew. Chem. Int. Ed.* **2018**, *57*, 1021-1024.
68. Hamayun, M. A.; Abramchuk, M.; Alnasir, H.; Khan, M.; Pak, C.; Lenhert, S.; Ghazanfari, L.; Shatruk, M.; Manzoor, S. Magnetic and magnetothermal studies of iron boride (FeB) nanoparticles. *J. Magn. Magn. Mater.* **2018**, *451*, 407-413.
69. Strouse, G. F.; Shatruk, M.; Carnevale, D. J. Ligand passivated core-shell Fe-Pt@CeO nanomagnets exhibiting enhanced energy product. *U.S. Pat. Appl. Publ.* **2017**, US 20170069412 A1 20170309.
70. Yergeshbayeva, S.; Hrudka, J. J.; Lengyel, J.; Erkasov, R.; Stoian, S. A.; Dragulescu-Andrasi, A.; Shatruk, M. Heteroleptic Fe(II) complexes with N_4S_2 coordination as a platform for designing spin-

crossover materials. *Inorg. Chem.* **2017**, *56*, 11096-11103.

71. Phan, H.; Hrudka, J. J.; Igimbayeva, D.; Lawson Daku, L. M.; Shatruk, M. A simple approach for predicting the spin state of homoleptic Fe(II) tris-diimine complexes. *J. Am. Chem. Soc.* **2017**, *139*, 6437-6447.
72. Shatruk, M. Chemical aspects of itinerant magnetism. In *Encyclopedia of Inorganic and Bioinorganic Chemistry*, Scott, R. A., Ed.; Wiley-VCH: Chichester, **2017**.
73. Tan, X.; Garlea, V. O.; Kovnir, K.; Thompson, C. M.; Xu, T.; Cao, H.; Chai, P.; Tener, Z. P.; Yan, S.; Xiong, P.; Shatruk, M. Complex magnetic phase diagram with multistep spin-flop transitions in $La_{0.25}Pr_{0.75}Co_2P_2$. *Phys. Rev. B* **2017**, *95*, 024428.
74. Menushenkov, A. P.; Yaroslavtsev, A. A.; Geondzhian, A. Y.; Chernikov, R. V.; Nataf, L.; Shatruk, M.; Tan, X. Driving the europium valence state in $EuCo_2As_2$ by external and internal impact. *J. Supercond. Novel Magn.* **2017**, *30*, 75-78.
75. Shatruk, M.; Gómes-Coca, S.; Dunbar, K. R. Molecular Magnetism. In *Molecular Magnetic Materials,* Sieklucka, B.; Pinkowicz, D., Eds.; Wiley, **2017**, Chapter 2, p. 29-51.
76. Shatruk, M.; Tan, X.; Chai, P. Method for tuning the ferromagnetic ordering temperature of aluminum iron boride. *PCT Int. Appl.* **2016**, WO 2016122856 A1 20160804.
77. Chai, P.; Abramchuk, M.; Shatruk, M. Synthesis, crystal structure, and magnetic properties of giant unit cell intermetallics, $R_{117}Co_{52+\delta}Sn_{112+\gamma}$ (R = Y, La, Pr, Nd, Ho). *Crystals* **2016**, *6*, 165.
78. Tan, X.; Yaroslavtsev, A. A.; Cao, H.; Geondzhian, A. Y.; Menushenkov, A. P.; Chernikov, R. V.; Nataf, L.; Garlea, V. O.; Shatruk, M. Controlling magnetic ordering in $Ca_{1-x}Eu_xCo_2As_2$ by chemical compression. *Chem. Mater.* **2016**, *28*, 7459-7469.
79. Mahapatra, T. S.; Basak, D.; Chand, S.; Lengyel, J.; Shatruk, M.; Bertolasi, V.; Ray, D. Competitive coordination aggregation for V-shaped [Co_3] and disc-like [Co_7] complexes: synthesis, magnetic properties and catechol oxidase activity. *Dalton Trans.* **2016**, *45*, 13576-13589.
80. Mohamed, R. K.; Mondal, S.; Guerrera, J. V.; Eaton, T. M.; Albrecht-Schmitt, T. E.; Shatruk, M.; Alabugin, I. Alkynes as linchpins for the additive annulation of biphenyls: convergent construction of functionalized fused helicenes. *Angew. Chem. Int. Ed.* **2016**, *55*, 12054-12058.
81. Carnevale, D. J.; Shatruk, M.; Strouse, G. F. Ligand passivated core-shell FePt@Co nanomagnets exhibiting enhanced energy product. *Chem. Mater.* **2016**, *28*, 5480-5487.
82. Arroyave, A.; Lennartson, A.; Dragulescu-Andrasi, A.; Pedersen, K. S.; Piligkos, S.; Stoian, S. A.; Greer, S. M.; Pak, C.; Hietsoi, O.; Phan, H.; Hill, S.; McKenzie, C. J.; Shatruk, M. Spin crossover in Fe(II) complexes with N_4S_2 coordination. *Inorg. Chem.* **2016**, *55*, 5904-5913.
83. Tan, X.; Fabbris, G.; Haskel, D.; Yaroslavtsev, A. A.; Cao, H. B.; Thompson, C. M.; Kovnir, K.; Menushenkov, A. P.; Chernikov, R. V.; Garlea, V. O.; Shatruk, M. A transition from localized to strongly correlated electron behavior and mixed valence driven by physical or chemical pressure in ACo_2As_2 (A = Eu, Ca). *J. Am. Chem. Soc.* **2016**, *138*, 2724-2731.
84. Dragulescu-Andrasi, A.; Miller, L. Z.; Chen, B.; McQuade, D. T.; Shatruk, M. Facile conversion of red phosphorous to soluble polyphosphide anions by reaction with potassium ethoxide. *Angew. Chem. Int. Ed.* **2016**, *55*, 3904-3908.
85. Tan, X.; Garlea, V. O.; Chai, P.; Geondzhian, A. Y.; Yaroslavtsev, A. A.; Xin, Y.; Menushenkov, A. P.; Chernikov, R. V.; Shatruk, M. Synthesis, crystal structure, and magnetism of $R_2Co_{12}As_7$ (R = Ca, Y, Ce-Yb). *J. Solid State Chem.* **2016**, *236*, 147-158.
86. Miller, L. Z.; Hrudka, J. J.; Naro, Y. R.; Haaf, M.; Shatruk, M.; McQuade, D. T. Rapid-flow synthesis of Zn-Qn complexes: teaching old ligands new tricks with reactive $Na_2(HZnEt_2)_2$. *J. Flow Chem.* **2015**, *5*, 139-141.
87. Pait, M.; Shatruk, M.; Ray, D. Anion coordination selective [Mn_3] and [Mn_4] assemblies: synthesis, structural diversity, magnetic properties and catechol oxidase activity. *Dalton Trans.* **2015**, *44*, 11741-11754.
88. Pait, M.; Shatruk, M.; Lengyel, J.; Gómez-Coca, S.; Bauzá, A.; Frontera, A.; Ray, D. Two types of nitrito support for μ_4-oxido-bridged [Cu_4] complexes: synthesis, crystal structures, magnetic properties and DFT analysis. *Dalton Trans.* **2015**, *44*, 6107-6117.

89. Li, G.; Hu, K.; Robson, K. C. D.; Gorelsky, S. I.; Meyer, G. J.; Berlinguette, C. P.; Shatruk, M. Tris-heteroleptic ruthenium-dipyrrinate chromophores in the dye-sensitized solar cell. *Chem. Eur. J.* **2015**, *21*, 2173-2181.

90. Phan, H..; Benjamin, S. M.; Steven, E.; Brooks, J. S.; Shatruk, M. Photomagnetic response in highly conductive Fe(II) spin-crossover complexes with TCNQ radicals. *Angew. Chem. Int. Ed.* **2015**, *54*, 823-827.

91. Shatruk, M.; Phan, H.; Chrisostomo, B. A.; Suleimenova, A. Symmetry-breaking structural phase transitions in spin crossover complexes. *Coord. Chem. Rev.* **2015**, *289-290*, 62-73.

92. Chai, P.; Stoian, S. A.; Tan, X.; Dube, P. A.; Shatruk, M. Investigation of magnetic properties and electronic structure of layered-structure borides AlT_2B_2 (T = Fe, Mn, Cr) and $AlFe_{2-x}Mn_xB_2$. *J. Solid State Chem.* **2015**, *224*, 52-61.

93. Menushenkov, A. P.; Yaroslavtsev, A. A.; Geondzhian, A. Y.; Chernikov, R. V.; Zubavichus, Y. V.; Tan, X.; Shatruk, M. Local electronic and crystal structure of magnetic RCo_2As_2 (R = La, Ce, Pr, Eu). *J. Supercond. Novel Magn.* **2015**, *28*, 995-997.

94. Hietsoi, O.; Dunk, P. W.; Stout, H. D.; Arroyave, A.; Kovnir, K.; Irons, R. E.; Kassenova, N.; Erkasov, R.; Achim, C.; Shatruk, M. Spin crossover in tetranuclear Fe(II) complexes, $\{[(tpma)Fe(\mu\text{-}CN)]_4\}X_4$ (X = ClO_4^-, BF_4^-). *Inorg. Chem.* **2014**, *53*, 13070-13077.

95. Longstreet, A. R.; Jo, M.; Chandler, R. R.; Hanson, K.; Zhan, N.; Hrudka, J. J.; Mattoussi, H.; Shatruk, M.; McQuade, D. T. Ylidenemalononitrile enamines as fluorescent “turn-on” indicators for primary amines. *J. Am. Chem. Soc.* **2014**, *136*, 15493-15496.

96. Lampen, P.; Phan, M. H.; Srikanth, H.; Kovnir, K.; Chai, P.; Shatruk, M. Heisenberg-like ferromagnetism in 3d-4f intermetallic $La_{0.75}Pr_{0.25}Co_2P_2$ with localized Co moments. *Phys. Rev. B* **2014**, *90*, 174404.

97. Nguyen, S.; Ryan, K.; Chai, P.; Shatruk, M.; Xin, Y.; Chapman, K.; Chupas, P.; Macaluso, R. $Pr_{1.33}Pt_4Ga_{10}$: superstructure and magnetism. *J. Solid State Chem.* **2014**, *220*, 9-16.

98. Thompson, C. M.; Kovnir, K.; Garlea, V. O.; Choi, E. S.; Zhou, H. D.; Shatruk, M. Unconventional magnetism in $ThCr_2Si_2$-type phosphides, $La_{1-x}Nd_xCo_2P_2$. *J. Mater. Chem. C* **2014**, *2*, 7561-7569.

99. Cross, J.; Villa, E.; Darling, V.; Polinski, M.; Lin, J.; Tan, X.; Kikugawa, N.; Baumbach, R.; Shatruk, M.; Albrecht-Schmitt, T. Straightforward reductive routes to air-stable uranium(III) and neptunium(III) materials. *Inorg. Chem.* **2014**, *53*, 7455-7466.

100. Diefenbach, K.; Lin, J.; Cross, J. N.; Dalal, N. S.; Shatruk, M.; Albrecht-Schmitt, T. E. Expansion of the rich structures and magnetic properties of neptunium selenites: soft ferromagnetism in $Np(SeO_3)_2$. *Inorg. Chem.* **2014**, *53*, 7154-7159.

101. Miller, L. Z.; Shatruk, M.; McQuade, D. T. Alkali metal oxides trapped by diethylzinc. *Chem. Commun.* **2014**, *50*, 8937-8940.

102. Zhou, S.; Mishra, T.; Wang, M.; Shatruk, M.; Cao, H.; Latturner, S. Synthesis, crystal structure, and magnetic properties of novel intermetallic compounds R_2Co_2SiC (R = Pr, Nd). *Inorg. Chem.* **2014**, *53*, 6141-6148.

103. Lekin, K.; Phan, H.; Winter, S.; Wong, J.; Leitch, A.; Laniel, D.; Yong, W.; Secco, R.; Tse, J.; Desgreniers, S.; Dube, P.; Shatruk, M.; Oakley, R. Heat, pressure and light-induced interconversion of bisdithiazolyl radicals and dimers. *J. Am. Chem. Soc.* **2014**, *136*, 8050-8062.

104. Thompson, C. M.; Tan, X.; Kovnir, K.; Garlea, V. O.; Gippius, A.; Yaroslavtsev, A. A.; Menushenkov, A. P.; Chernikov, R. V.; Büttgen, N.; Krätschmer, W.; Zubavichus, Y. V.; Shatruk, M. Synthesis, structures, and magnetic properties of rare-earth cobalt arsenides, RCo_2As_2 (R = La, Ce, Pr, Nd). *Chem. Mater.* **2014**, *26*, 3825-3837.

105. Li, G.; Yella, A.; Brown, D. G.; Gorelsky, S. I.; Nazeeruddin, M. K.; Grätzel, M.; Berlinguette, C. P.; Shatruk, M. Near-IR photoresponse of Ru-dipyrrinate terpyridine sensitizers in the dye-sensitized solar cells. *Inorg. Chem.* **2014**, *53*, 5417-5419.

106. Polinski, M. J.; Garner, E. B.; Maurice, R.; Planas, N.; Stritzinger, J. T.; Parker, T. G.; Cross, J. N.; Green, T. D.; Alekseev, E. V.; Van Cleve, S. M.; Depmeier, W.; Gagliardi, L.; Shatruk, M.; Knappenberger, K. L.; Liu, G.; Skanthakumar, S.; Soderholm, L.; Dixon, D. A.; Albrecht-Schmitt, T. E. Unusual structure, bonding and properties in a californium borate. *Nature Chem.* **2014**, *6*, 387-392.

107. Gippius, A. A.; Verchenko, V. Yu.; Tkachev, A. V.; Gervits, N. E.; Lue, C. S.; Tsirlin, A. A.; Büttgen, N.; Krätschmer, W.; Baenitz, M.; Shatruk, M.; Shevelkov, A. V. Interplay between localized and itinerant magnetism in Co substituted $FeGa_3$. *Phys. Rev. B* **2014**, *89*, 104426.

108. Lin, J.; Chai, P.; Diefenbach, K.; Shatruk, M.; Albrecht-Schmitt, T. E. Challenges in the search for magnetic coupling in 3*d*-4*f* materials: syntheses, structures, and magnetic properties of the lanthanide copper heterobimetallic compounds, $RE_2Cu(TeO_3)_2(SO_4)_2$. *Chem. Mater.* **2014**, *26*, 2187–2194.

109. Macaluso, R. T.; Shatruk, M.; Chai, P.; Hong, H.; Wangeline, C.; Ryan, K.; Holton, P.; Allaz, J.; Morrison, G.; Fulfer, B.; Fronczek, F.; Chan, J. Y. Synthesis, structure, and magnetic behavior of $(La_xCe_{1-x})_{1.33}Pt_4Ga_{10}$ ($0 \le x \le 1$). *J. Alloys Compd.* **2014**, *600*, 193-198.

110. Simmons, J. T.; Yuan, Z.; Daykin, K. L.; Nguyen, B. T.; Clark, R. J.; Shatruk, M.; Zhu, L. Bis[N-alkyl-N,N-di(2-pyridylmethyl)amine]zinc(II) perchlorates display cis-facial stereochemistry in solid state and solution. *Supramol. Chem.* **2014**, *26*, 214-222.

111. Ghosh, A. K.; Pait, M.; Shatruk, M.; Bertolasi, V.; Ray, D. Self-assembly of a $[Ni_8]$ carbonate cube incorporating four μ_4-carbonato linkers through fixation of atmospheric CO_2 by ligated $[Ni_2]$ complexes. *Dalton Trans.* **2014**, *43*, 1970-1973.

112. Yaroslavtsev, A. A.; Menushenkov, A. P.; Zaluzhnyy, I. A.; Chernikov, R. V.; Caliebe, W.; Thompson, C. M.; Arico, A. A.; Kovnir, K.; Shatruk, M. Local electronic and crystal structure of rare-earth cobalt phosphides RCo_2P_2 (R = La, Ce, Pr, Nd, Eu) studied by XAFS and RIXS. *J. Phys. Conf. Ser.* **2013**, *430*, 012105.

113. Ghosh, A. K.; Shatruk, M.; Bertolasi, V.; Pramanik, K.; Ray, D. Self-assembled tetra- and pentanuclear nickel(II) aggregates from phenoxido-based ligand bound $\{Ni_2\}$ fragments: carboxylate bridge controlled structures. *Inorg. Chem.* **2013**, *52*, 13894-13903.

114. Phan, H.; Lekin, K.; Winter, S. M.; Oakley, R. T.; Shatruk, M. Photoinduced solid state conversion of a radical σ-dimer to a π-radical pair. *J. Am. Chem. Soc.* **2013**, *135*, 15674-15677.

115. Kovnir, K.; Thompson, C. M.; Garlea, V. O.; Haskel, D.; Polyanskii, A. A.; Zhou, H.; Shatruk, M. Modification of magnetic anisotropy through 3d-4f coupling in $La_{0.75}Pr_{0.25}Co_2P_2$. *Phys. Rev. B* **2013**, *88*, 104429.

116. Li, G.; Hu, K.; Yi, C.; Knappenberger, K. L.; Meyer, G. J.; Gorelsky, S. I.; Shatruk, M. Panchromatic light harvesting and hot electron injection by Ru(II) dipyrrinates on TiO_2 surface. *J. Phys. Chem. C* **2013**, *117*, 17399-17411.

117. Kassenova, N.; Hietsoi, O.; Erkassov, R. Sh.; Shatruk, M. Tetraethylammonium salt of tetraphenylporphyrinatoiron(III) dicyanide. *Acta Cryst. E* **2013**, *69*, m462-m463.

118. Ondrusek, B. A.; Opalka, S. M.; Hietsoi, O.; Shatruk, M.; McQuade, D. T. Structure and reactivity of a copper(I)-fused N-heterocyclic carbene complex: reactivity toward styrenic and strained alkenes. *SynLett* **2013**, *24*, 1211-1214.

119. Keniley, L. K.; Dupont, N.; Ray, L.; Ding, J.; Kovnir, K.; Hoyt, J. M.; Hauser, A.; Shatruk, M. Complexes with redox-active ligands: synthesis, structure, electrochemical and photophysical behavior of Ru(II) complex with TTF-annulated phenanthroline. *Inorg. Chem.* **2013**, *52*, 8040-8052.

120. Tan, X.; Chai, P.; Thompson, C. M.; Shatruk, M. Magnetocaloric effect in $AlFe_2B_2$: towards magnetic refrigerants from earth-abundant elements. *J. Am. Chem. Soc.* **2013**, *135*, 9553-9557.

121. Shatruk, M.; Alabugin, I. V. Reinvestigation of “Single-crystal X-ray structure of 1,3-dimethylcyclobutadiene…”. *Chem. Eur. J.* **2013**, *19*, 4942-4945.

122. Dunbar, K. R.; Achim. C.; Shatruk, M. Charge transfer-induced spin transitions in cyanometallate materials. In *Spin-Crossover Materials: Properties and Applications*, Halcrow, M. A., Ed.; John Wiley & Sons, Oxford, UK, **2013**, Chapter 6, 171-202.

123. Phan, H.; Chakraborty, P.; Chen, M.; Calm, Y. M.; Kovnir, K.; Keniley, L. K.; Hoyt, J. M.; Knowles, E. S.; Besnard, C.; Meisel, M. W.; Hauser, A.; Achim, C.; Shatruk, M. Heteroleptic Fe(II) complexes of 2,2'-biimidazole and its alkylated derivatives: Spin-crossover and photomagnetic behavior. *Chem. Eur. J.* **2012**, *18*, 4942-4945.

124. Wang, J.; Ozarowski, A.; Kovnir, K.; Thompson, C. M.; Yaroslavtsev, A. A.; Chernikov, R. V.; Dalal, N. S.; Shatruk, M. Trimetallic $[M_3(dpa)_4]^{2+}$ complexes (M = Co, Ni) as building blocks for cyanide-

bridged coordination polymers. *Eur. J. Inorg. Chem.* **2012**, 4652-4660.

125. Li, G.; Bomben, P. G.; Robson, K. C. D.; Gorelsky, S. I.; Berlinguette, C. P.; Shatruk, M. Ru complexes of thienyl-functionalized dipyrrins as NCS-free sensitizers for the dye-sensitized solar cell. *Chem. Commun.* **2012**, *47*, 8790-8792.
126. Yaroslavtsev, A. A.; Menushenkov, A. P.; Chernikov, R. V.; Caliebe, W.; Zaluzhnyy, I. A.; Thompson, C. M.; Kovnir, K.; Shatruk, M. Resonant inelastic X-ray scattering (RIXS) on magnetic $EuCo_2P_2$-based systems. *JETP Lett.* **2012**, *96*, 44-48.
127. Menushenkov, A. P.; Yaroslavtsev, A. A.; Grishina, O. V.; Chernikov, R. V.; Arico, A. A.; Thompson, C. M.; Kovnir, K.; Shatruk, M. Local electronic and crystal structure of rare-earth cobalt phosphides RCo_2P_2 studies by XAFS spectroscopy. *Solid State Phenomena* **2012**, *190*, 200-203.
128. Guha, P. M.; Phan, H.; Kinyon, J. S.; Brotherton, W. S.; Sreenath, K.; Simmons, J. T.; Clark, R. J.; Dalal, N. S.; Shatruk, M.; Zhu, L. Structurally diverse copper(II) complexes of polyaza ligands containing 1,2,3-triazoles – site selectivity and magnetic properties. *Inorg. Chem.* **2012**, *51*, 3465-3477.
129. Li, G.; Ray, L.; Glass, E. N.; Kovnir, K.; Khoroshutin, A.; Gorelsky, S. I.; Shatruk, M. Synthesis of panchromatic Ru(II) thienyl-dipyrrin complexes and evaluation of their light-harvesting capacity. *Inorg. Chem.* **2012**, *51*, 1614-1624.
130. Ostrovsky, S.; Palii, A.; Klokishner, S.; Shatruk, M.; Funck, K.; Achim, C.; Dunbar, K. R.; Tsukerblat, B. Vibronic approach to the cooperative spin transitions in crystals based on cyano-bridged pentanuclear M_2Fe_3 (M=Co, Os) clusters. *Prog. Theor. Chem. Phys.* **2012**, *23*, 379-395.
131. Kovnir, K.; Garlea, V. O.; Thompson, C. M.; Zhou, H. D.; Reiff, W. M.; Ozarowski, A.; Shatruk, M. Spin-glass behavior in $LaFe_xCo_{2-x}P_2$ solid solutions: Interplay between magnetic properties and crystal and electronic structures. *Inorg. Chem.* **2011**, *50*, 10274-10283.
132. Thompson, C. M.; Kovnir, K.; Zhou, H. D.; Shatruk, M. Magnetism of rare-earth cobalt phosphides $GdCo_3P_2$ and $GdCo_5P_3$. *Z. anorg. allg. Chem.* **2011**, 637, 2013-2017.
133. Giles, I. D.; Chifotides, H. T.; Shatruk, M.; Dunbar, K. R. Anion-templated self-assembly of highly stable Fe(II) pentagonal metallacycles with short anion-π contacts. *Chem. Commun.* **2011**, *47*, 12604-12606.
134. Kovnir, K.; Shatruk, M. Magnetism in giant unit cells: Crystal structure and magnetic properties of $R_{117}Co_{52+\delta}Sn_{112+\gamma}$ (R = Sm, Tb, Dy). *Eur. J. Inorg. Chem.* **2011**, 3955-3962.
135. Klokishner, S.; Ostrovsky, S.; Palii, A.; Shatruk, M.; Funck, K.; Dunbar, K. R.; Tsukerblat, B. Vibronic model for cooperative spin-crossover in pentanuclear $\{[M^{III}(CN)_6]_2[M'^{II}(tmphen)_2]_3\}$ (M/M′ = Co/Fe, Fe/Fe) compounds. *J. Phys. Chem. C*, **2011**, *115*, 21666-21677.
136. Kovnir, K.; Reiff, W. M.; Menushenkov, A. P.; Yaroslavtsev, A. A.; Chernikov, R. V.; Shatruk, M. "Chemical metamagnetism": From antiferromagnetic $PrCo_2P_2$ to ferromagnetic $Pr_{0.8}Eu_{0.2}Co_2P_2$ via chemical compression. *Chem. Mater.* **2011**, *23*, 3021-3024.
137. Thompson, C. M.; Kovnir, K.; Eveland, S.; Herring, M. J.; Shatruk, M. Synthesis of $ThCr_2Si_2$-type arsenides from Bi flux. *Chem. Commun.* **2011**, *47*, 5563-5565.
138. Brotherton, W. S.; Guha, P. M.; Phan, H.; Clark, R. J.; Shatruk M.; Zhu, L. Tridentate complexes of 2,6-bis(4-substituted-1,2,3-triazol-1-ylmethyl)pyridine and its organic azide precursors: an application of the copper(II) acetate-accelerated azide–alkyne cycloaddition. *Dalton Trans.* **2011**, *40*, 3655-3665.
139. Alabugin, I. V.; Gold, B.; Shatruk, M.; Kovnir, K. Comment on "Single-crystal X-ray structure of 1,3-dimethylcyclobutadiene by confinement in a crystalline matrix. *Science* **2010**, *330*, 1047.
140. Shatruk, M.; Ray, L. Ligands derived from tetrathiafulvalene: Building blocks for multifunctional materials. *Dalton Trans.* **2010**, *39*, 11105-11121.
141. Park, J. K.; Lackey, H. H.; Rexford, M. D.; Kovnir, K.; Shatruk, M.; McQuade, D. T. A chiral 6-membered *N*-heterocyclic carbene copper(I) complex that induces high stereoselectivity. *Org. Lett.* **2010**, *12*, 5008-5011.
142. Karadas, F.; Shatruk, M.; Perez, L. M.; Dunbar, K. R. Cyanide-bridged $[Co^{II}_2M^{II}_2]$ and $[Co^{II}_2M^{II}_2]$ complexes based on the $[Co^{II}(triphos)(CN)_2]$ building block: Synthesis, structures, magnetic properties, and density functional theoretical studies. *Chem. Eur. J.* **2010**, *16*, 7164-7173.
143. Thompson, C. M.; Arico, A. A.; Kovnir, K.; Shatruk, M. Control of magnetic ordering by altering Co-Co

distances in $La_{0.9}R_{0.1}Co_2P_2$ (R = Ce, Pr, Nd, and Sm) phases with $ThCr_2Si_2$-type structure. *J. Appl. Phys.* **2010**, *107*, 09E316.

144. Kovnir, K.; Thompson, C. M.; Zhou, H. D.; Wiebe, C. R.; Shatruk, M. Tuning ferro- and metamagnetic transitions in rare-earth cobalt phosphides $La_{1-x}Pr_xCo_2P_2$. *Chem. Mater.* **2010**, *22*, 1704-1713.
145. Wikstrom, J. P.; Filatov, A. S.; Mikhalyova, E. A.; Shatruk, M.; Foxman, B. M.; Rybak-Akimova, E. V. Carbonate formation within a nickel dimer: synthesis of a coordinatively unsaturated bis(μ-hydroxo) dinickel complex and its reactivity toward carbon dioxide. *Dalton Trans.* **2010**, *39*, 2504-2514.
146. Keniley, L. K.; Ray, L.; Kovnir, K.; Dellinger, L. A.; Hoyt, J. M.; Shatruk, M. TTF-annulated phenanthroline and unexpected oxidative cleavage of the C=C bond in its Ru(II) complex. *Inorg. Chem.* **2010**, *49*, 1307-1309.
147. Hilfiger, M. G.; Chen, M.; Brinzari, T. V.; Nocera, T. M.; Shatruk, M.; Petasis, D. T.; Musfeldt, J. L.; Achim, C.; Dunbar, K. R. An unprecedented charge transfer induced spin transition in an Fe-Os cluster. *Angew. Chem. Int. Ed.* **2010**, *49*, 1410-1413.
148. Avendano, C.; Karadas, F.; Hilfiger, M.; Shatruk, M.; Dunbar, K. R. Cyanide lability and linkage isomerism of hexacyanochromate(III) induced by the Co(II) ion. *Inorg. Chem.* **2010**, *49*, 583-594.
149. Palii, A. V.; Reu, O. S.; Ostrovsky, S. M.; Klokishner, S. I.; Tsukerblat, B. S.; Hilfiger, M.; Shatruk, M.; Prosvirin, A.; Dunbar, K. R. Highly anisotropic exchange interactions in a trigonal bipyramidal cyanide-bridged $Ni^{II}_3Os^{III}_2$ cluster. *J. Phys. Chem. A* **2009**, *113*, 6886-6890.
150. Funck, K. E.; Hilfiger, M. G.; Berlinguette, C. P.; Shatruk, M.; Wernsdorfer, W.; Dunbar, K. R. Pentanuclear trigonal-bipyramidal cyanide complexes: A powerful platform for the systematic assessment of the magnetic properties of cyanide-bridged compounds. *Inorg. Chem.* **2009**, *48*, 3438-3452.
151. Shatruk M.; Avendaño, C.; Dunbar, K. R. Cyanide-bridged complexes of transition metals: A molecular magnetism perspective. *Prog. Inorg. Chem.* **2009**, *56*, 155-334.
152. Scott, T. A.; Ooro, B. A.; Collins, D. J.; Shatruk, M.; Yakovenko, A.; Dunbar, K. R.; Zhou, H.-C. After 118 years, the isolation of two common radical anion reductants as simple, stable solids. *Chem. Commun.* **2009**, 65-67.
153. Hilfiger, M. G.; Shatruk, M.; Prosvirin, A. V.; Dunbar, K. R. Hexacyanoosmate(III) chemistry: Preparation and magnetic properties of a pentanuclear cluster and a Prussian blue analogue with Ni(II). *Chem. Commun.* **2008**, 5752-5754.
154. Karadas, F.; Schelter, E. J.; Shatruk, M.; Prosvirin, A. V.; Bacsa, J.; Smirnov, D.; Ozarowski, A.; Krzystek, J.; Telser, J.; Dunbar, K. R. A family of cyanide-bridged molecular squares: Structural and magnetic properties of $[\{M^{II}Cl_2\}_2\{Co^{II}(triphos)(CN)_2\}_2]\cdot xCH_2Cl_2$, M = Mn, Fe, Co, Ni, Zn. *Inorg. Chem.* **2008**, *47*, 2074-2082.
155. Lopez, N.; Zhao, H.; Prosvirin, A. V.; Chouai, A.; Shatruk, M.; Dunbar K. R. Conversion of a porous material based on a Mn^{II}-$TCNQF_4$ honeycomb net to a molecular magnet upon desolvation. *Chem. Commun.* **2007**, 4611-4613.
156. Li, B.; Zhang, H.; Huynh, L.; Shatruk, M.; Dikarev, E. V. Mo/Rh carboxylate: Heterometallic compound built of homometallic paddlewheel units. *Inorg. Chem.*, **2007**, *46*, 9155-9159.
157. Zhao, H.; Shatruk, M.; Prosvirin, A. V.; Dunbar, K. R. Variation of heterometallic structural motifs based on $[W(CN)_8]^{3-}$ anions and Mn^{II} ions as a function of synthetic conditions. *Chem. Eur. J.*, **2007**, *13*, 6573-6589.
158. Shatruk, M.; Chambers, K. E.; Prosvirin, A. V.; Dunbar, K. R. Systematic investigation of trigonal-bipyramidal cyanide-bridged clusters of the first row transition metals. *Inorg. Chem.*, **2007**, *46*, 5155-5165.
159. Shatruk, M.; Dragulescu-Andrasi, A.; Chambers, K. E.; Stoian, S. A.; Bominaar, E. L.; Achim, C.; Dunbar, K. R. Properties of Prussian blue materials manifested in molecular complexes: Observation of cyanide linkage isomerism and spin crossover behavior in pentanuclear cyanide clusters. *J. Am. Chem. Soc.* **2007**, *129*, 6104-6116.
160. Uzelmeier, C. E.; Smucker, B. W.; Reinheimer, E. W.; Shatruk, M.; O'Neal, A. W.; Fourmigué, M.; Dunbar, K. R. A series of complexes of the phosphorus-based TTF ligand *o*-P2 with the metal ions

Fe^{II}, Co^{II}, Ni^{II}, Pd^{II}, Pt^{II}, and Ag^{I}. *Dalton Trans.* **2006**, 5259-5268.

161. Shatruk, M.; Chouai, A.; Dunbar, K. R. Influence of anions on the dimensionality of extended networks based on Cu^{I} cations and 1,4,5,8,9,12-hexaazatriphenylene (HAT) ligands. *Dalton Trans.* **2006**, 2184-2191.
162. Schottel, B. L.; Chifotides, H.; Shatruk, M.; Chouai, A.; Perez, L. M.; Bacsa, J.; Dunbar, K. R. Anion-π interactions as controlling elements in self-assembly reactions of Ag(I) complexes with π-acidic aromatic rings. *J. Am. Chem. Soc.* **2006**, *128*, 5895-5912.
163. Angeles-Boza, A. M.; Bradley, P. M.; Fu, P. K.-L.; Shatruk, M.; Hilfiger, M.; Dunbar, K. R.; Turro, C. Photocytotoxicity of a new Rh_2(II,II) complex: Increase in cytotoxicity upon irradiation similar to that of PDT agent hematoporphyrin. *Inorg. Chem.* **2005**, *44*, 7262-7264.
164. Kovnir, K. A.; Shatruk, M. M.; Reshetova, L. N.; Presniakov, I. A.; Dikarev, E. V.; Baitinger, M.; Haarmann, F.; Schnelle, W.; Baenitz, M.; Grin, Y.; Shevelkov, A. V. Novel compounds $Sn_{20}Zn_4P_{22-v}I_8$ (v = 1.2), $Sn_{17}Zn_7P_{22}I_8$, and $Sn_{17}Zn_7P_{22}Br_8$: Synthesis, properties, and special features of their clathrate-like crystal structures. *Solid State Sci.* **2005**, *7*, 957-968.
165. Shatruk, M.; Chouai, A.; Prosvirin, A. V.; Dunbar, K. R. Structural and magnetic properties of iron(II) complexes with 1,4,5,8,9,12-hexaazatriphenylene (HAT). *Dalton Trans.* **2005**, 1897-1902.
166. Schelter, E. J.; Shatruk, M.; Heintz, R. A.; Galán-Mascarós, J. R.; Dunbar, K. R. Unexpected conversion of a hexacyanometallate to a homoleptic nitrile complex with triphenylborane substituents. *Chem. Commun.* **2005**, 1417-1419.
167. Shatruk, M.; Lee, S. Rh_3Ga_5: a new intermetallic compound in the rhodium–gallium system and its crystal structure. *J. Alloys Compd.* **2003**, *359*, 124-127.
168. Olenev, A. V.; Baranov, A. I.; Shatruk, M. M.; Tyablikov, A. S.; Shevelkov, A. V. Synthesis and the crystal structure of $[Hg_6As_4](InCl_6)Cl$: influence of covalent and electrostatic factors on the supramolecular structure. *Russ. Chem. Bull.* **2002**, *51*, 444-448.
169. Olenev, A. V.; Shatruk, M. M.; Shevelkov, A. V.; Popovkin, B. A. Synthesis and crystal structure of the supramolecular solid solution $[Hg_6As_xSb_{4-x}](SbBr_6)Br$. *Russ. J. Inorg. Chem.* **2001**, *46*, 1615-1618.
170. Shatruk, M. M.; Kovnir, K. A.; Lindsjö, M.; Presniakov, I. A.; Kloo, L. A.; Shevelkov, A. V. Novel compoudns $Sn_{10}In_{14}P_{22}I_8$ and $Sn_{14}In_{10}P_{21.2}I_8$ with clathrate I structure: Synthesis and crystal and electronic structure. *J. Solid State Chem.* **2001**, *161*, 233-242.
171. Shevelkov, A. V.; Shatruk, M. M. Mercury and cadmium pnictidehalides: The inverted Zintl phases. *Russ. Chem. Bull.* **2001**, *50*, 337-352.
172. Shatruk, M. M.; Kovnir, K. A.; Shevelkov, A. V.; Popovkin, B. A. Ag_3SnP_7: A polyphosphide with a unique $_\infty^1(P_7)$ chain and a novel Ag_3Sn heterocluster. *Angew. Chem. Int. Ed.* **2000**, *39*, 2508-2509.
173. Shatruk, M. M.; Reshetova, L. N.; Shevelkov, A. V.; Popovkin, B. A. $Cd_5P_2Br_4$ – the first cadmium analog of the Millon's base salts. *Russ. J. Inorg. Chem.* **2000**, *45*, 565-569.
174. Shatruk, M. M.; Kovnir, K. A.; Shevelkov, A. V.; Popovkin, B. A. A new Zintl phase $Sn_{19.3}Cu_{4.7}P_{22}I_8$ with a structure of the clathrate-I type: directional synthesis and structure. *Russ. J. Inorg. Chem.* **2000**, *45*, 203-209.
175. Shatruk, M. M.; Kovnir, K. A.; Shevelkov, A. V.; Presniakov, I. A.; Popovkin, B. A. First tin pnictide halides $Sn_{24}P_{19.3}I_8$ and $Sn_{24}As_{19.3}I_8$: Synthesis and the clathrate-I type of the crystal structure. *Inorg. Chem.* **1999**, *38*, 3455-3457.
176. Shatruk, M. M.; Mustiakimov, M. Yu.; Shevelkov, A. V.; Popovkin, B. A. Solid solutions of $Hg_7P_{6-x}As_xBr_4$ – structures containing angular anions $(Z_3)^{5-}$ (Z = P, As). *Russ. J. Inorg. Chem.* **1998**, *43*, 1069-1072.
177. Shatruk, M. M.; Olenev, A. V.; Shevelkov, A. V.; Popovkin, B. A. Character of the distribution of two varying elements of Group 15 in $_\infty^1(Z^-)$ chains (Z = P, As, Sb) in Cd_2As_3I solid solutions. *Russ. J. Inorg. Chem.* **1997**, *42*, 1610-1613.