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Editorial

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At least for now, it appears that the rate of consumption of steel in the world is slowing down. According to the forecast of the World Steel Association, the global steel consumption growth is anticipated to slow to 3·6% in 2012, from 5·6% in 2011. This has been attributed to the less steel-intensive growth phase in China and the continued debt crisis in the Eurozone and, in general, the associated uncertainty in Europe.[1]

Innovation continues to be the key to enhancing the life of steel. Research scientists at the US Naval Research Laboratory have been working on methods to fight corrosion in metals. One of these methods involves the use of impressed current cathodic protection, a method the Navy uses to protect the underwater portion of a ship's hull from corrosion.[2] The first of the papers in this issue of Emerging Materials Research focuses on the cyclic fatigue fracture behavior of two high strength specialty steels.[3] This paper by T. S. Srivatsan and collaborators, from the University of Akron, describes the stress related properties of steels. The authors discuss the key mechanisms that are responsible for the observed fracture behavior of the two steels.

Electronic materials including semiconductors continue to evolve because of their ability to be tailored for a variety of applications. Their applications in electronics, optics, optoelectronics and energy components and systems have been on an exponential rise. The second paper in this issue of the Journal is a review of selenides for nonlinear optical applications. This paper by N. B. Singh and collaborators, from the University of Maryland and Northrop Grumman, summarizes their extensive studies of several binary, ternary, and quaternary selenide crystals for nonlinear optical applications.[4]

Hydrogen as a source of fuel and a potential replacement for oil has been the focus of research by several laboratories. In fact, it is anticipated that the long-term future of the world is based on a hydrogen economy.[5] The third paper, in this issue, focuses on the applications of ZnO:GaN thin films for photoelectrochemical (PEC) water splitting.[6] This paper by Sudhakar Shet and collaborators, from the National Renewable Energy Laboratory and New Jersey Institute of Technology, suggests a potential method for synthesizing heterogeneous photocatalysts with both high crystallinity and bandgap reduction, which should help to improve the PEC performance of ZnO.

Batteries are a major component in a variety of applications including automotive, solar, wind etc. for energy storage and to be able to supply power on demand as well as to interface with the grid. Electrochemical devices with high energy and power densities are currently powered only by batteries with organic liquid electrolytes. But such batteries require relatively stringent safety precautions leading to complex and expensive large-scale systems.[7] The paper, electrical conduction of superionic conductors: Na_2ZrO_3, by Shivendu Tripathi, K. M. Mishra, and S. N. Tiwari, from Gorakhpur University, India, reports a study of the thermoelectric power and electrical conductivity of Na_2ZrO_3.[8] The authors report that, in the superionic phase, Na^+ ions are the main entity of charge carriers and Paddle wheel mechanism suitably explains the transport mechanism. They further find that, in the normal phase, the conduction is mainly due to Frenkel defects. The enthalpy for migration and heat of transport have also been evaluated in both normal and superionic phases of the compound.

The use of natural resources to develop new applications is an interesting area of science. From a sustainability standpoint and from the view point of optimizing available natural resources, there has been renewed interest in seeking new avenues. The last two papers in this issue of Emerging Materials Research focus on such applications. The paper, Halloysite as support matrices: a review, by Rawtani Deepak and Y. K. Agrawal of Institute of Research & Development, Gujarat Forensic Sciences University, India, focuses on the use of Halloysite as an attractive candidate to perform as a catalytic support for polymerization as well as immobilization reactions.[9] Applications of Halloysite include various fields such as controlled drug release, nano templating, sorption, and fabrication of polymer nanocomposites. The last paper, nanoscience of cementitious materials, by Nakshatra Bahadur Singh of Gorakhpur University and Shiv Sharan Das of Sharda University, India, presents a study of the Nanoscience of cementitious materials.[10] Various nanodimensional supplementary cementitious materials are being added to concrete in order to enhance its strength and durability.

REFERENCES

1. Global steel consumption growth to slow in 2012, http://www.miningweekly.com/article/global-steel-consumption-growth-to-slow-in-2012-2012-04-30 (accessed 14 July 2012).

2. Naval Researchers Fight Metal Corrosion, Design News, http://www.designnews.com/document.asp?doc_id=247154&f_src=designnews_gnews&dfpPParams=ind_183,industry_gov,aid_247154&dfpLayout=article (accessed 14 July 2012).
3. Srivatsan, T. S.; Manigandan, K.; Quick, T.; Schmidt, M. L. Mechanisms governing cyclic fracture behavior of two high-strength steels: role of composition and microstructure. *Emerging Materials Research* **2012**, *1*(4), 170–184.
4. Singh, N. B.; Kanner, G.; Marable. M.; *et al*. Selenides for nonlinear optical applications. *Emerging Materials Research* **2012**, *1*(4), 185–200.
5. Photoelectrochemical Water Splitting http://gcep.stanford.edu/pdfs/hydrogen_workshop/MacQueen.pdf (accessed 14 July 2012).
6. Shet, S.; Yan, Y.; Wang, H.; Ravindra, N.; Turner, J.; Al-Jassim, M. ZnO:GaN thin films for photoelectrochemical water splitting application. *Emerging Materials Research* **2012**, *1*(4), 201–204.
7. Kamaya, N.; Homma, K.; Yamakawa, Y.; *et al*. A lithium superionic conductor. *Nature Materials* **2011**, *10*, 682–686.
8. Tripathi, S.; Mishra, K. M.; Tiwari, S. N. Electrical conduction of superionic conductors: Na_2ZrO_3. *Emerging Materials Research* **2012**, *1*(4), 205–211.
9. Deepak, R.; Agrawal, Y. K. Halloysite as support matrices: a review. *Emerging Materials Research* **2012**, *1*(4), 212–220.
10. Singh, N. B.; Das, S. S. Nanoscience of cementitious materials. *Emerging Materials Research* **2012**, *1*(4), 221–234.