High-Entropy Materials Technology

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"High-Entropy Materials (HEMs)" has become an emerging field through the collective efforts of many researchers in last two decades. The compositional concept of HEMs is based on at least five major components, which is revolutionary because historically the compositional concept is based on one or two components. Under the new compositional concept, the periodic table of elements could generate limitless material compositions for people's research, development and applications.

High entropy effect, which was ignored before, is the most important core effect because it could enhance the formation of multielement solution phases and avoid complicated microstructure with complex phases in materials. Lattice distortion effect, sluggish diffusion effect and cocktail effect are also the core effects of HEMs because they significantly affect the crystal structure, microstructure, and thus properties. Therefore, the understanding of these four effects is helpful to understand HEMs.

As the long-standing bottlenecks of conventional materials were difficult to be solved by conventional materials concept, HEMs could increase our whole materials ability to solve the conventional bottlenecks. Many HEMs in different categories have been developed and published, which indeed display promising properties for different applications.

In this presentation, many bottlenecks in conventional materials and the ESG issues in energy, waste, pollution, natural resource conservation are pointed out. Lots of new opportunities are waiting for us to develop new HEMs and related materials simultaneously meeting with ESG criteria. Some industrialized examples of HEMs technology are presented.

References

1. "High-Entropy Alloys – Fundamentals and Applications", 2016, 1st edn. M. C. Gao, J. W. Yeh, P. K. Liaw, Y. Zhang (eds), Springer International Publishing, Cham, Switzerland.