

## **Key Technologies for the Future Breakthrough in Materials Science and Engineering**

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Seeing the conventional technologies in a better light often brought us an innovation of industrial products. As an example, there are the following cases.

- (1) Effects of transformation strain in electrode of Li-ion batteries
- (2) Formation and structure of anodic films on magnesium alloys
- (3) Improvement of properties of ferrite magnets by controlling the grain boundary.

Lithium ion batteries are one of the hottest current topics in the global scale as auto makers in the world speed the developments of electric vehicles (EVs) and plug-in hybrid EVs. For the practical applications, the deterioration mechanism of the batteries during lithiation and delithiation in an electrode of Li-ion batteries. We noted the effect of strain due to lithiation in the electrode of the batteries on its deterioration. In this study, we have reported that the contribution of the elastic-strain energy to the chemical free energy of formation is useful to understand the experimental electrode potential. Magnesium alloys in the second example have been known as a metal with high-specific strength. Specially, a material with high-specific strength becomes more important to raise the range of EV. Corrosion resistance and strength at high temperature of a magnesium alloy, however, must be improved for this application. Careful studies of surface treatment and metallographic analyses are what counts. For the improvement of energy efficiency as well as a loss of vehicle weight, a magnet performance of electric motors is another important factor. Here, a study of the sintering process during fabrication of magnets must be carried out.

Consequently, in all the developments of the products which will support the EVs and plug-in hybrid EVs, for example, an idea based on the basic physical metallurgy, such as, thermodynamics, surface treatment, material mechanics, material texture, ceramics sintering, phase transformation, etc, is crucial. Finally, I conclude that the original technology will be germinated by students educated the basic academic subjects and the product innovation will be based on it.