On the Processing and Microstructure Optimisation of Fe_2VAl-based Compounds for Low Grade Heat Harvesting

Camille van der Rest[1], Geoffrey Roy[1], Aude Simar[1], Pascal J. Jacques[1].

[1] Université catholique de Louvain, Institute of Mechanics, Materials and Civil engineering, IMAP, Place St Barbe 2, B-1348 Louvain-la-Neuve, Belgium (camille.vanderrest@uclouvain.be)

Harvesting of low grade heat from industrial processes through the thermoelectric effect would be economical and environmentally friendly. However, for large-scale applications, thermoelectric materials must be cheaper, more readily available and less toxic than conventional ones such as bismuth telluride. Compounds based on Fe_2VAl are good candidates for such large-scale devices since they meet these requirements and present an adequate power factor in the temperature range from 300 to 500 K.

The present study investigates $(Fe_{2/3}V_{1/3})_{100-y}Al_y$ Heusler-related compounds and their thermoelectric properties. Tuning the aluminum content brings about p- and n-type materials with optimised Seebeck coefficients. Among the investigated processing routes, casting followed by thermomechanical processing brings about Seebeck coefficients of about $150\mu V.K^{-1}$ and $-100\mu V.K^{-1}$, respectively. The parameters of the specific thermomechanical treatments that need to be applied to give some ductility to the intermetallic compounds were identified and optimised. Their influence on the microstructure and functional properties has also been examined. Finally, the occurrence, but also the influence, of the order/disorder transitions have been highlighted.

Presentation: Oral
Session: Fuel Cells, Hydrogen Storage Technologies, Batteries, Supercapacitors & Thermoelectric Materials