

Prof. Dr. Jan Frenzel

Leiter Forschungsgruppe Werkstoffprocessing,
Lehrstuhl Werkstoffwissenschaft

Ruhr-Universität Bochum

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High Entropy Shape Memory Alloys

High-entropy shape memory alloys (HE-SMA) represent a relatively new and novel type of shape memory alloy (SMA). Unlike conventional NiTi SMAs, they not only contain the two basic elements Ni and Ti, but also consist of additional components, with all elements having almost equal proportions. The special feature of HE-SMAs is that they exhibit relatively high transformation temperatures and can exhibit good functional stability. Most importantly, they show interesting shape memory properties already in the as-cast state without the need for thermomechanical treatment. In the present work, various HE-SMAs were melted in an electric arc furnace, then heat treated and investigated in detail thermally and microscopically. It was observed that HE-SMAs can exhibit particular microstructural heterogeneities, and that the composition dependence of transformation temperatures differs significantly from what is known from conventional NiTi-based SMAs. Based on the results, new strategies for the development of shape memory alloys can be derived.