

Conference in Portoroz

Invited Presentation by Prof. Markus Rettenmayr, FSU Jena

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Alloy development using modern tools

Considering new demands with respect to performance and properties of modern alloys, alloy development is challenging and will be a continuous challenge in the next decades.

The phase diagram is the basis for alloy development, processing (leading to a favorable microstructure) is based on the knowledge on phase selection, growth and morphology of the phase diagram. Up to present, the phase diagrams of most binary alloys and a few hundred ternary alloys have been determined consistently. However, most technical alloys contain more than two or three alloying elements, even more so if the impurities that may exert considerable influence are taken into account.

Conventional alloy development based on trial-and-error approaches has been shown to be tedious and may nowadays be too time consuming considering the rapid change in practical applications. For a new generation of a given alloy generally far more than 100 alloys need to be synthesized and characterized. To achieve such a task in a pertinent amount of time, extrapolation methods and high-throughput methods, each with its own strengths, are at present being developed.

In the presentation it is shown how useful sets of data can be generated systematically, how large concentration ranges can be excluded from experimental studies, and how preliminary data on melting range and mechanical properties can be assessed. A new method of annealing in temperature gradients is introduced that yields information on microstructure and properties in targeted concentration ranges (almost) irrespective of the number of alloying elements. Examples are solder alloys and conventional and active brazes.