

Cluster-assembled materials

Horst Hahn, Gleb Iankevich, Ramin Shadkam
*Institute of Nanotechnology (INT), Karlsruhe Institute of Technology (KIT),
Germany*

Isolated clusters, entities containing a few to a few hundred of atoms, have been studied for decades for their special structures and physical, chemical and quantum properties. Clusters can also be used as building blocks for functional materials, requiring the controlled assembly of individual clusters. At INT, a custom-made UHV-system incorporating a cluster source, a 90° bending magnet for mass selection and controlled deposition positions is available for the preparation of cluster-assembled materials. These materials can consist of crystalline and amorphous clusters of one size and elemental composition, which are deposited on a substrate with controlled impact energy. Alternatively, size-selected clusters can be deposited under controlled conditions and be embedded into a matrix material, with free choice of size and concentration of clusters in the matrix. Several examples of cluster-assembled metallic glasses and composite materials consisting of miscible and immiscible elements will be shown. The emphasis is on the description of the synthesis route, the atomic structure and the properties of the cluster-assembled materials.