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Supersonic cluster beams: a powerful method for the deposition of nanostructured thin films with tailored properties

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Deposition of clusters from the gas phase has been proposed as an interesting technique for the synthesis of controlled nanostructures on surfaces. Among different experimental approaches, supersonic clusters beam deposition has been shown as a viable route for the production of nanostructured systems ranging from organized nanoislands to nanostructured thin films. To this goals the development of highly intense cluster source is a necessary requisite together with the capability of size selecting the aggregates prior to deposition, while maintaining high particle fluxes.

By using a pulsed microplasma cluster source and by exploiting aerodynamical effects typical of supersonic beams it is possible to obtain very high deposition rates with a control on neutral cluster mass distribution, allowing the deposition of thin films with controlled nanostructure. Due to high deposition rates, high lateral resolution, low temperature processing supersonic cluster beams can also be used for the micro and nanopatterning of cluster-assembled films when little or no post-growth manipulation or assembly is required.

For example the nano and mesostructure of films obtained by carbon cluster beam deposition can be controlled by selecting in the beam the elemental building blocks, moreover functional properties such as field emission can be controlled and tailored

The use of supersonic cluster beams opens also new perspectives for the production of nanostructured films with novel physico-chemical and topological properties such as nanostructured carbon matrices containing carbide and transition metal particles. Few examples will be discussed.