## Nanocomposites and nanomaterials

# Solidification mechanisms and martensitic transformations in micron and nano- sized powder particles elaborated by spark-erosion technique in cryogenic liquids

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The mechanisms of formation of micron and nano-sized powders of the functional shape memory B2 alloys Ti-Ni [1], Ni-Al [2], Ni-Mn-Ga [3], Cu-Al-Ni [2], glass-forming alloy Zr-Ni-Cu-Ti-Al and pure Ti obtained by spark erosion method in liquid nitrogen and argon are considered. Powder particles sized from 0.1 to 50-70 microns have a spherical shape, indicating their formation by solidification of liquid droplets. Particles with sizes less than 100 nm form a nano-fraction appearing by condensation from the vapor phase. Nucleation of solid phase occurs inside the liquid particles and often has a single event character in case that there is no active interaction of the molten particles with the surrounding gas shell. Nucleation of solid phase in porous particles occurs at their surface and has a multiple event character. Micron sized powder particles of shape memory alloys consist of austenite and martensite phases at room temperature. Martensitic transformation in fine standalone in some of B2 alloys is featured the absence of self-accommodating martensite. The twins inside such nanosized particles, which are rather the internal defects of martensite, provide compensation the increasing in surface energy of particle due to the phase transformation and/or the minimization of the transformation strains under the constraints such as oxide layer. The presence of martensite phase in nano-sized particles is controlled by the composition, which may differ significantly from the composition of bulk samples.

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2. *Monastyrsky G.E., Ochin P. Gilchuk A.V. at all* The role of nano-sized fraction on spark plasma sintering the pre-alloyed spark-erosion powders // Journal of Nano- and Electronic Physics, -2012.-4:1.**P**.1007-1-7
3. *Ochin P. Gilchuk A.V., Monastyrsky G.E. at all* Martensitic Transformation in Spark Plasma Sintered Compacts of Ni-Mn-Ga Powders Prepared by Spark Erosion Method in Cryogenic Liquids // *Mat.Sci. Forum*, -2013.-**738-739**.-P. 451-455