Nanoobjects microscopy

Martensite structure in the spark plasma sintered Cu-Al-Ni

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The microstructure of Cu-Al-Ni shape memory alloy, which was sintered by spark plasma sintering method [1], is considerable interest because is giving good opportunity to study the martensitic transformation in submicron and nanosized grains that constrained by the surrounding nanoceramic [2]. The material were elaborated by spark plasma sintering (SPS) method from the powder particles prepared by spark-erosion (SE) method in liquid argon [3] from preliminary melted master alloys with the composition of Cu-13.0Al-3.9Ni-0.4Ti-0.2Crwt.%. To avoid the decomposition of the alloy during SPS the temperatures of sintering 700°C and duration 1 min were chosen. Powder was annealed in H_2 atmosphere before SPS.

TEM study revealed that mostly spherical particles of Cu-Al-Ni are embedded in the ceramic matrix – the mix of Al_2O_3 and Cu_2O nanosized particles. Both 2H and M18R martensite has been found in the micron sized particles. 2H martensite appeared in the particles with the dimensions much more than one micron, while 18R dominates in submicron particles. The most interesting result is that martensite of only one orientation occupied the whole volume of nanosized particles (50-200nm). The structure of such nanosized particles was rather 6R than 18R with irregular microtwins or perhaps stacking faults defects. The different compositions of the particles of different sizes, the stresses produced by constrains (such as surrounding nanoceramics) or size effect by itself are seems responsible for such various microstructure of martensite.

1. *R.A. Portier, at all*, Spark plasma sintering of Cu-Al-Ni shape memory alloy // Journal of Alloys and Compounds.–2013.–**577S1.**–P. S472-S477.
2. *G.E. Monastyrsky, A.V. Kotko at all*, Microstructure investigation of the spark plasma sintered Cu-Al-Ni shape memory material // Металлофизика и новейшие технологии.–2014.– **36,** №8.–P. 1091-1099.
3. *G.E. Monastyrsky, at all*, Получение электроискровым методом порошков сплавов с эффектом памяти формы // Порошковая металлургия.–2007.–**5/6.**–P. 3-15.