Title: *Complex investigation of fine-grained polycrystals of Cu and CuZr alloy processed by equal channel angular pressing and high pressure torsion*

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Abstract: *In the thesis the microstructure development, mechanical, elastic and corrosion properties of deformed specimens of pure Cu and binary alloy CuZr processed by equal channel angular pressing (ECAP) are investigated. Several properties of pure Cu processed by ECAP are compared with properties of the same material processed by high pressure torsion (HPT).*

The microstructure development is characterized in detail by several experimental techniques (light and electron microscopy, electron back scatter diffraction, positron annihilation spectroscopy, etc.). The microstructure development in specimens processed by ECAP is characterized by the continuous fragmentation of the initial coarse grain structure and the formation of new grains having the sizes in the submicrocrystalline range (of 460 nm and 260 nm in Cu and CuZr alloy, respectively). During the deformation by ECAP the fraction of high-angle grain boundaries, the dislocation density and the concentration of vacancies are continuously increasing to final values of 80%, $7x10^{15}$ $m^{-2}$and 10^{-4} at^{-1}, respectively. The correlation between the degree of the strain imposed by ECAP and the anisotropy of elastic properties was found. The strain due to ECAP enhances the rate of corrosion. However, the corrosion in the fine-grained material is homogeneous over the whole surface and the passivation protective layers are easily formed. The fine-grained structure remains stable up only to 150° - 200°C in pure Cu. On the other hand, in CuZr alloy, thanks to fine precipitates of CuZr phase, is the fine-grained structure stabilized up to 650°C. In the disc shape specimens processed by HPT different microstructure development was observed with significant differences in properties at the specimen centre and in the regions near the edge. This corresponds well to the inhomogeneous character of strain induced by HPT. The grain refinement was found to be more effective by HPT than by ECAP for the same strain. As a result the average grain size of the fragmented microstructure after HPT is smaller than in the material processed by ECAP.

Key words: *fine-grained material, CuZr, ECAP, HPT, microstructure development*