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Study of mechanical behavior of cryogenic rolled pure metals

Deformation of metals at cryogenic temperatures (CT), or at temperatures close to liquid nitrogen (LN) temperature can suppress partly the dynamic recovery during deformation, allowing a higher final density of defects in the material than on a deformation at room temperature (RT). In another way, unusual deformation mechanisms can take place on cryogenic conditions. The dynamic recovery and recrystallization has a great dependence on stacking fault energy and on annealing characteristics due the dislocations distributions are a function of this energy. Annealing uses part of the stored energy in the material to the formation of new grains with low density of defects. In the present work pure metals with different stacking fault energy; aluminum (high), copper (medium) and silver (low); were rolled on room and cryogenic temperature and the products evaluate by tensile tests and hardness measurements just after rolling and after aging on room temperature. The results right after rolling show no great difference on tensile test curves but after aging, a very greater recovering of silver than other evaluated metals was detected. As showed on figure, both the rolled silver at room temperature and cryogenic temperature exibihit a great recovering level. In other side, the cryogenic rolling on silver promotes a higher tensile resistance and higher elongation after aging than the silver rolled at room temperature. This phenomenon can be due the unrecoverable defects at room temperature generated by deformations mechanism, which occurs at very low temperature (twinning).

Biography

Osvaldo Mitsuyuki Cintho has his expertise in high energy ball milling, cryogenic highenergy ball milling and cryogenic deformation processes. For analysis of these processes products, he developed devices and techniques like cryogenic x-ray diffraction system, cryogenic samples preparation methods for TEM-Transmission Electron Microscopy, Cryogenic system for the XTMS: x-ray diffraction and thermo mechanical system on Synchrotron line. Currently, he is researching about mechanical behavior and characterization of metals and steels on cryogenic conditions in order to propose a deformation mechanisms and recovering processes on this condition.

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