

Mechanical properties and microstructure evolution of multilayered Al-Cu hybrid materials produced by high-pressure torsion

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High-pressure torsion (HPT) was used to produce nanostructured multilayered hybrid Al-Cu systems. Three-layered blocks of Al/Cu/Al and Cu/Al/Cu were subjected to up to 200 revolutions of HPT. Both systems were examined by X-ray diffraction, scanning and transmission electron microscopy (SEM-TEM), energy dispersive spectrometry (EDX), microhardness measurements and tensile tests. The SEM and TEM observations revealed the formation of nano-layered structures in both configurations but they differed significantly in terms of grain size, which was smaller for the Al/Cu/Al system. XRD and selected area electron diffraction (SAED) analysis confirmed the formation of intermetallic CuAl_2 and Cu_9Al_4 phases, whose fraction was higher for the Al/Cu/Al system. Higher microhardness (500 Hv) was obtained for the Al/Cu/Al system. The results demonstrate that HPT offers a significant opportunity for producing novel nanostructured Al-Cu multilayered composites with unique mechanical properties.