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Synthesis of Nanosized Amorphous Alumina Particles and Their Use in Electroless Ni-P Coatings

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Abstract : The present study focuses on the preparation of Al2O3 nanoparticles by top down approach i.e. mechanical milling using high energy planetary ball mill at 250 rpm for 40h. The milled Al2O3 nanoparticles are then used as the second phase to develop electroless (EL) Ni-P- Al2O3 nanocomposite coatings on mild steel substrate. An alkaline bath was used with a suspension of Al2O3 particles (4 g/L) for the synthesis of Ni-P-Al2O3 nanocomposite coating. The surface morphology, size range and phase analysis of as-prepared Al2O3 particles and the coatings were characterized using X-ray diffraction (XRD) and field emission scanning electron microscopy (FESEM). The coatings were heat treated at 400°C for 1h in argon atmosphere and the hardness of the nanocomposite coatings was investigated with respect to Ni-P before and after heat treatment. The results showed that as milled Al2O3 nanoparticles exhibit irregular shaped and size ranges around 40-45 nm. The Al2O3 particles are uniformly distributed in Ni-P matrix. The microhardness of the coatings is found to be significantly improved after heat treatment (1126 VHN).

Keywords : Electroless (EL), Ni-P-Al2O3, nanocomposite, mechanical milling, microhardness