Functionally Graded Nickel Matrix Alumina Reinforced Nanocomposites AUSTIN YOUNG, STEPHEN FARIAS, ROBERT CAMMARATA, Dept. of Materials Science & Engineering, Johns Hopkins University — Hierarchical structured nanocomposites are of great interest particularly in the fields of defense, aeronautics, and metamaterials. Previous work has demonstrated the ability to create uniform nickel matrices embedded with aluminum oxide nanoparticles via electrodeposition using a rotating disk electrode (RDE) [1]. This process allows for controlled enhancement of yield strength without negatively affecting other properties [2]. The speed of the RDE controls the rate of particle incorporation, and therefore, particle volume fraction. Hierarchical structures can be formed by simply changing the rotation rate during electrodeposition. This allows for controlled variations of composite structure throughout the material. Simply layered and functionally graded hierarchical materials have been produced using this method with structural resolution of the order of single microns. These layered structures produced unique mechanical properties, even exceeding those of uniformly dispersed composites.

[1] J.W. Kaczmar et al, The production and Application of metal matrix composite materials, 63 (2000)
[2] Ingrid, Synthesis and characterization of particle reinforced $NiAl_2O_3$ and $FeCoTiO_2$ nanocomposites, Ch.4.

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