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J Material Sci Eng 2016, 5:10(Suppl)
http://dx.doi.org/10.4172/2169-0022.C1.056

International Conference and Exhibition on

Polymer Chemistry

November 14-16, 2016 Atlanta, USA

Influence of deposition parameters on formation of cobalt nanowires

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To understand the mechanism for formation of fcc-cobalt nanowires in electrodeposition, we have systematically studied the effect of deposition potential, pH, deposition temperature and electrolytic cell concentration on the formation of fcc Co nanowires by X-ray diffraction (XRD), transmission electron microscope (TEM) and scanning electron microscope (SEM). The Co nanowires deposited at the potential of -1.6V are pure hcp phase. When increasing the value of potential to -2.0V, there are hcp Co and fcc Co crystals in the deposited nanowires. The fraction of fcc Co crystals in the nanowires increases with increasing the potential value. At -3.0V, the nanowires are pure fcc Co. The pH of the solution has little effect on formation of fcc Co nanowires. We have also seen that high concentration and low temperature favors fcc phase whereas low concentration and high temperature favors hcp phase. However, at 35oC the co-occurrence of hcp and fcc phases were also observed. These experimental results can be explained by the classical electrochemical nucleation theory. The formation of fcc Co crystals can be attributed to smaller critical clusters formed at a higher potential value since the smaller critical clusters favor formation of fcc nuclei.

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Effect of ammonium and aminosilane montmorillonites organoclays on the curing kinetics of unsaturated polyester (UP) resin nanocomposites

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The curing kinetics of UP nanocomposites prepared by incorporating different amounts of two kinds of organo-montmorillonite (organo-MMT): trimethyl octadecacyl ammonium chloride (TMOA) and aminopropyl-triethoxysilane (APTES) were studied by non-isothermal differential scanning calorimetry (DSC) experiments. Small angle X-ray scattering (SAXS) was used for measuring the d-spacings in the modified organoclays and no intercalation UP into these clays was observed for the nanocomposites. HRTEM images showed dispersed and agglomerated platelets in UP/APTES 2 and 10 wt%. DSC analysis showed two peaks in UP resins and UP/organo-MMT and a decrease in the exothermal peaks temperature (Tp1 and Tp2) for nanocomposites with the heating rate as compared with those of neat UP system; thus, the higher the heating rate, the higher the curing reaction rate. This effect was more clearly on the UP/MMT-APTES nanocomposites. The effective activation energies (Ea) were determined with the model-free isoconversional Starik's method. Sestak-Berggren model was chosen to simulate the reaction rate with a good match achieved. Thermal gravimetric analysis showed that the cured UP/APTES at high concentration were slightly more stable than UP and TMOA.

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