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The complexing in copper(II) salt (flame retardant) – polyamine (hardener) system as an effective way to the combustibility decrease of epoxy-amine polymeric materials

Helen Lavrenyuk and Borys Mykhalichko
Lviv State University of Life Safety, Ukraine

Among great number of polyamines, the diethylenetriamine *(deta)* is widely used as a curing agent in the production of epoxy resins. The polymeric materials on the basis of epoxy resins, *viz*. thermoset polymers, are one of the most important polymer systems used today in the industry, ranging from simple two-part adhesives to high-tech applications On the other hand, *deta* is a potentially tridentate ligand which can form chelate bonds with transition metal atoms, in particular, with copper(II). This feature of deta behavior has allowed us to solve a problem related to the elaboration of new polymeric materials with the decreased combustibility using the following approach: crystaline copper vitriol (flame retardant) was added to epoxy-amine resin. In this process the chemical interaction of deta (a curing agent of epoxy resins) with noncombustible copper vitriol (copper(II) sulfate pentahydrate) in many respects predetermines the properties of $[Cu(deta)H_2O]SO_4.H_2O$ as flame retardant-hardener. The total energy of three Cu–N bonds which belong to the square-pyramidal coordination core equals 237.39 $kJ \cdot mol^{-1}$. These strong coordination bonds that arise between metal atoms of incombustible $CuSO_4$ and N atoms of the amine hardener – *deta* as well as formation of stable chelate complex in solid state are responsible for the flammability suppression of the modified epoxy-amine composite material. Appositely, works directed towards the use of chelate complexes with participation of other transition metal salts in the production of self-extinguishing epoxy-amine composites are under way

olaw@ukr.net

Characteristics of in-fight powder particles and thermal barrier gradient coatings by plasma spray

Jing Chen, Sheng Lu, Zhao-peng Liu, Shu-hua Mao, Ze-xin Wang and Li-hui Tian
Jiangsu University of Science and Technology, China

In the present work, three kinds of coatings, i.e.NiCoCrAl-Y_2O_3 coating, NiCoCrAl-Y_2O_3/AZ50 thermal barrier coating and NiCoCrAl-Y_2O_3/AZ50 thermal barrier gradient coating, were sprayed on the surface of K417 nickel-based high temperature alloy by plasma spraying. The physical characteristics of in-flight particles and related influences of spraying process parameters were investigated by Spray Watch on-line measuring system. The surface roughness and microstructure characteristics of the coatings were studied by Confocal Laser Scanning Microscopy (CLSM) Scanning Electron Microscopy (SEM), Energy Dispersive Spectroscopy (EDS) and X-ray Diffraction (XRD). The bonding strength, hardness distribution, and thermal shock properties of the coatings were evaluated by tensile, microhardness, and thermal shock tests. The water bath thermostatic method and Oxyacetylene flame heating method were used to investigate the thermal barrier effects of the coatings with different structures. The results show that the bonding strengths and thermal shock resistances of the two kinds of thermal barrier coating are higher than that of the standard HB7269-1996, which are 15MPa and 6 times respectively

lusheng88168@qq.com