UREA–FORMALDEHYDE RESINS REINFORCED WITH AMINO-GROUPS-MODIFIED MWCNTs

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Urea-formaldehyde adhesives comprise about 80% of the amino resins produced worldwide and are the most prominent example of thermosetting resins. They are the major adhesives in the forest products industry because they have various advantages including low cost, ease of use under a wide variety of curing conditions, low cure temperatures, water solubility, resistance to microorganisms and to abrasion, hardness, lack of colour, especially the cured ones and excellent thermal properties. As these resins are mostly used for interior applications, it is important the panels manufactured with them to have good mechanical properties and low formaldehyde emissions.

In this study, MWCNTS modified to their surface with amino groups were used as reinforcing materials of urea-formaldehyde resins. The amino-MWCNTS were prepared by the Aristotle University of Thessaloniki, while the new resins were synthesised by CHIMAR HELLAS S.A. The modified MWCNTS were added during the synthesis of a typical urea-formaldehyde resin, at the level of 1%w/w under vigorous blending. The resin was mixed with hardener and water and was sprayed on chips suitable for the production of particleboards. The boards were prepared according to the relative industrial practice and had density of 680kg/m^3.

It was found that the new resins had properties close to that of a typical urea-formaldehyde In particular, the use of amino groups-modified MWCNTS resulted in resins having somewhat higher pH, buffer capacity and gel time, but lower water tolerance. The maximum curing temperature of the experimental resins is also slightly shifted to lower values compared with a typical UF resin (control resin) while both resins loose mass practically with the same rate according to Thermogravimetric Analysis (TGA) studies.

The particleboards produced with the new resins at lab scale were firstly conditioned and then subjected to tests for the evaluation of their mechanical properties, dimensional stability (thickness swelling) in humid conditions and formaldehyde content according to the relative European standards. It was found that amino modified MWCNTS improve the internal bond while leave all other properties practically at the same level of the control UF resin. Such panels are suitable for the manufacturing of furniture and other interior applications.

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