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ISOCYANATE REACTIVITY IN WOOD BONDING

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Due to the current debate concerning possible stricter guidelines for the emission of formaldehyde from wood-based materials, an enhanced potential for isocyanates as cross-linking adhesive components can be seen. It is already known that both low transverse tensile strengths and the limited hydrolytic stability of aminoplastic resin-bonded wood-based materials can be compensated for through the addition of isocyanate[1]. Isocyanates are highly-reactive compounds which react with a multitude of functional groups in an addition reaction. For this reason, the increased application of isocyanates – for example in the form of polymeric diphenylmethane diisocyanate (pMDI) – as components in various commonly-available adhesives is conceivable, in order to ultimately also improve the material properties.

The application of isocyanates in wood bonding may not, however, be regarded as trivial. Firstly, their high reactivity must

be controlled and their tendency to readily penetrate the wood which is to be bonded must be reduced. The research group Gluing, Bonding and Adhesives from the Fraunhofer Institute for Wood Research WKI has been intensively focusing on solution approaches for these issues for several years. It was therefore possible, in a project funded by the Fraunhofer-Gesellschaft, to encapsulate pMDI in such a way that it is first released and activated under pressure during hot pressing in the wood-based material production[2]. Furthermore, blocked and thereby concurrently also controllable isocyanates were developed in a project funded by the International Association for Technical Issues related to Wood e.V. IVTH. These isocyanates are unblocked and activated through the application of heat in the hot press. Secondly, knowledge concerning the reactivity of isocyanates with chemically-differing adhesive types is of significant interest, whereby as far as is known, no publications are available

on this subject. In view of this, the project “Isocyanate reactivity” has been initiated at the Fraunhofer WKI, with funding through the iVTH and the Fraunhofer WKI. Currently being investigated is whether, during the curing process, the reduction of the isocyanate absorption band in the wave number range 2300-2250 cm^{-1} by means of Fourier transformation infrared spectroscopy (FTIR) can be followed as a measurement of the isocyanate reactivity. This analysis would enable the decrease in the isocyanate concentration to be followed directly by means of the decrease in the reacting isocyanate group and also the drawing of conclusions concerning the relative abreaction rate of the isocyanate.

[1] M. Dunky, P. Niemz. Holzwerkstoffe und Leime, 2002, Springer-Verlag, Berlin, P. 282.

[2] A. Zillessen, A. Ritter, A. Sengespeick, L. Karsch, E. Jelen. DE102012100672 A1, Mikroverkapselte Isocyanate und Verfahren zur Herstellung hierfür sowie deren Anwendung in Klebstoffen (Microencapsulated isocyanates, method for the production thereof, and use thereof in adhesives), 2013.