Dispersion coating with carboxylated and cross-linked styrene-butadiene latices

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Abstract

Polymer dispersions can be used for coating paper products in order to e.g. enhance their barrier properties. The influence of characteristics such as the degree of cross-linking (the gel content), glass transition temperature and degree of carboxylation of styrene-butadiene (SB) latex polymers on the mechanical properties and water vapour permeability of the corresponding polymer coating films at room temperature has been investigated. The storage modulus in the rubbery region increased markedly with increasing degree of cross-linking and the blocking (sticking tendency) towards adjacent paper substrates was in general somewhat lower at higher cross-link densities. There was also a tendency for the water vapour permeability to decrease somewhat with higher degrees of cross-linking. The degrees of carboxylation were quite low for the studied SB-dispersions and it had only a minor influence on the mechanical performance and barrier properties of the films. Reducing the glass transition temperature significantly below room temperature had a negative effect with regard to the blocking/sticking tendency of the polymer and on the water vapour permeability. On the other hand, a glass transition temperature significantly above room temperature resulted in a coating film with microcracks that caused a marked deterioration in the physical properties. These films were rather brittle with a low elongation at break. An important result was that the performance (including a reduction in water vapour transmission rate) of the coated products was significantly enhanced by a pretreatment (precoating or high-temperature calendering) of the board. This was interpreted as being the result of a more homogeneous polymer layer on the substrate. In most cases, the paperboard was coated on a pilot scale and a higher drying temperature improved the film formation up to a certain limit. Too high a drying intensity resulted in the appearance of defects in the polymer layer. The differences in properties between the coated specimens that could be associated with the polymer characteristics were not marked, but a higher degree of cross-linking and a lower degree of carboxylation gave the best results. The water vapour transmission rate of the coated board was substantially reduced by the addition to the coating colour of a small amount of paraffin wax. Contact angle measurements and electron spectroscopy for chemical analysis (ESCA) indicated that this was due to a migration of the wax to the surface of the polymer film during drying. The wax addition also reduced the tendency for the polymer layer to stick (block) at elevated temperatures.