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Statistical Characterization of Phenolic-Novolak Structures

Three statistical methods are applied sequentially to characterize the structure of a phenolic-novolak. The first evaluates the total number of phenolic nuclei and methylene moieties that compose the average prepolymer molecule. The second evaluates the fraction of the total phenolic nuclei that are joined to the main structure by a single bond and are therefore pendent. The number average molecular weight for the prepolymer is calculated from these data. The third method is used to characterize the structure of the cured phenolic-novolak in terms of the ratio of equivalents of curing agent to equivalents of prepolymer for any extent of cure. The sol fraction and the fraction of pendent phenolic nuclei that remain after curing are expressed in the same terms.

Two discernible, overlapping reactions occur when phenolic-novolaks are pyrolytically decomposed. The extents of these reactions are related to the structure of the prepolymer and the extent of the crosslinking reaction. Thus, the fraction of the phenolic-novolak that is involved in each of the two pyrolysis reactions can be expressed in terms of the structure of the prepolymer and the extent of the curing reactions. Experimental pyrolysis is only needed to determine the kinetic parameters for the pyrolysis reactions.

The statistical methods described appear to be of general validity, and may prove valuable for characterizing any polymer which results from chain polymerization of multifunctional branching monomers linked through bifunctional monomers.

Note:

Requests for further information may be directed to:

Technology Utilization Officer
Ames Research Center
Moffett Field, California 94035
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Patent status:

No patent action is contemplated by NASA.

Source: E. L. Winkler and J. A. Parker
Ames Research Center
(ARC-10393)

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