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Liquid Ethylene-Propylene Copolymers

A new class of oligomers has been produced by thermally degrading commercially-available ethylene-propylene rubber (EPR). It has been found that EPR does not melt when subjected to elevated temperatures, but rather it partially degrades to liquid oligomers. The molecular weight and the viscosity of these liquids can be predetermined by the process temperature.

One advantage of the oligomeric ethylene-propylene copolymers is their low viscosity for a given molecular weight, as compared to analogous oligomeric poly(isobutylene). This makes them easier to use in processing. In addition, the ethylene-propylene copolymers contain an olefinic unsaturation of approximately 2 equivalents/mole. This feature facilitates their use as precursors to hydroxyl prepolymers capable of curing to elastomers by the use of standard methods.

The new oligomers are prepared by heating solid EPR in a container that retains the solid and permits the liquid product to flow out as it is formed. In a typical experimental procedure, a Vycor tube 2.5 cm in diameter and 50 cm long is fitted in the cover of a 500-ml resin kettle. A loose-fitting disk-shaped plug is held in the tube by a constriction, located about 9 cm from the bottom of the tube, and the tube is filled with borosilicate Raschig rings to approximately 13 cm above the disk. A condenser connects the top of the tube to a collecting flask.

Small pieces of EPR are introduced into the Vycor tube, and a tube furnace is used to heat them to 350° C. A nitrogen counterflow is introduced into the resin kettle, up the tube, and out of the condenser. As the degradation proceeds, liquid oligomer is collected in the resin kettle, solid EPR remains in the tube, and volatile byproducts are carried out through the condenser to the collecting flask.

With an EPR sample of 210 g, the yield is 179 g (84.7 percent) of oligomer and 20 g of volatile product. Alternate experimental procedures have been used with temperatures up to 600° C; the best yield was 92.8 percent at 430° C. Oligomer molecular weights achieved varied from around 1,400 to 8,300, and unsaturation varied from 1.62 to 2.52 equivalents/mole, both depending upon the experimental conditions.

Note:

Requests for further information may be directed to:

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Patent status:

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