[Macromolecules, **26**, 1990-1995 (1993)] [Lab. of Pharm. Physical Chemistry]

Nature of Plasma-Induced Surface Radicals of Powdered Polyethylene Studied by Electron Spin Resonance.

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Plasma-induced polyethylene (PE) radicals were studied by electron spin resonance (ESR). The room temperature ESR spectrum of plasma-irradiated PE exhibits an apparent sextet spectrum. It was found that the room temperature ESR spectrum consists of three kinds of spectral components: a sextet spectrum (I), a septet spectrum (II), and a smeared-out broad line (III). The sextet and septet spectra were assigned to the midchain alkyl radical,and the allylic radical, respectively. The smeared-out broad line was assigned to an immobilized dangling-bond site(DBS) at the surface cross-linked region. The nature of radical formation of PE was found to be reflected by the presence or absence of unsaturated bonds in the virgin sample in a very sensitive manner.

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Nature of Plasma-Induced Free Radical Formation of Several Fibrous Polypeptides.

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The electron paramagnetic resonance (EPR) spectral features of several plasma-irradiated fibrous polypeptides (scleroproteins), such as silk, wool and collagen vary with materials, but remain unchanged during the course of plasma irradiation in each case. It is difficult to identify the full structures of polypeptide radicals from EPR spectroscopic evidence alone, since proteins consist of many kinds of amino acid units. Nevertheless, systematic computer simulations indicated that plasma susceptibility for radical formation is rather specific in amino acids, that is glycine-derived radicals (-ĊHNHCO-) in silk and collagen, and sulphide radicals (-RS·) in wool as a major radical.

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Nature of Plasma-Induced Free Radicals in Polycarbohydrates Studied by Electron Spin Resonance.

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We report the special features of plasma-induced cellulose radicals on its comparison with those of amylose. Cellulose is more plasma-sensitive than its anomeric polymer, amylose. But, the decay rate of cellulose radicals is higher than that of amylose. The most interesting contrast in the ESR spectra between cellulose and amylose is that the spectra of plasma-irradiated cellulose contain a large amount of isotropic triplet with ca. 2.8mT of HSC in addition to the doublet, while those of plasma-irradiated amylose contain only a negligible amount of the triplet. The triplet in cellulose is most resonably assigned to a hydroxylalkyl radical at C2 and/or C3 split by two axial β-hydrogens. Such a discrepancy in the radical formation between two anomeric polymers is discussed based on the higher order structure of polymers.