

Connection Between the Carotid Plaque Instability and Paramagnetic Properties of the Intrinsic Mn²⁺ Ions

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Abstract

© 2016, Springer Science+Business Media New York. The pulsed W-band (the microwave frequency of 94 GHz, magnetic field of 3.4 T) electron paramagnetic resonance (EPR) comparative studies of a series of 20 atherosclerotic plaques (AP) obtained during carotid endarterectomy in patients with atherosclerosis is presented. The AP stability was established by ultrasound angiography. In all of the obtained species EPR spectra due to the presence of Mn²⁺ ions in a crystal matrix of hydroxyapatites (HAp) is observed. The existence of HAp in plaque fragments is confirmed by X-ray diffraction analyses. The spectral parameters of Mn²⁺ are ascribed to two possible locations in the HAp constituent of the atherosclerotic plaques. The difference in the electronic relaxation times of T_{2e} for Mn²⁺ ions in stable and unstable plaques is observed that can indicate the more homogeneous distribution of Mn²⁺ in stable plaques as compared to unstable species. The results can be potentially used for the understanding the mechanisms of pathological calcifications and AP stability.

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Keywords

Atherosclerotic plaque, Electronic relaxation times, High-field electron paramagnetic resonance, Hydroxyapatite, Manganese