

(DIBK). Spectra of two first compounds were obtained by classical spectrophotometry of a 1% solution in water or hexane vs. pure solvent. The spectra are shown in Fig.2. Comparison of spectra of t-butyl peroxide and irradiated PP shows (Fig.3) that the absorption band 210 nm is caused by the peroxide bond (-O-O-) connected to two carbon atoms.

The spectra of two other compounds mentioned above and suspected of the absorption were obtain-

ed in another way. Non-irradiated PP was impregnated with a 1% solution of DIPK or DIBK in methanol. As a reference served PP impregnated with pure methanol. Fig.4 shows the spectra obtained by the DRS method. In both cases the maximum lies at 288 nm, which corresponds with the absorption band 260÷280 nm in irradiated PP. This agreement is the evidence that this band is caused by the ketone group (>C=O), which is formed during oxidation of PP.

ELECTRON PARAMAGNETIC RESONANCE SPECTROMETRY (EPR) FOR DATING OF PALEOANTHROPOLOGICAL NURAGHI SKELETAL TISSUES

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In a close co-operation with the University of Sassari, Italy and the Medical Academy in Warsaw the dating of skeletons of Nuraghi population living in Sardinia, Italy, centuries BC, based on the quantitative evaluation of the concentration of stable paramagnetic species produced by ionising radiation in tooth enamel, was performed by quantitative EPR spectrometry [1]. The nuragic culture was developed from 1600 to 500 BC and is characterised by the appearance of absolutely original megalithic monument, the so called "Nuraghi". The remains of bones and teeth, the object of the study, were found in the "Tombs of the Giants" assigned to this culture and discovered in La Testa, St. Teresa di Gallura, Sardinia in 1990 after the fire that burned the surrounding thicket.

The purpose of the study was dating of the Nuraghi skeletal tissue with the use of electron paramagnetic resonance technique based on the phenomenon of the interaction of both cosmic rays and natural radioactivity of the soil surrounding the remains with bone mineral. The interaction results in the formation of a very stable radical ion CO_2^{-1} (time constant at 37°C equal to 1.9×10^5 years) giving a rise in EPR to a very specific asymmetric singlet. The intensity of the signal is proportional to the absorbed dose. The advantage of the present dating procedure was that in the close vicinity of Nuraghi tomb the Roman skeletons of the known age were also discovered. Thus, it was possible by applying the additive dose method (successive irradiation of samples at the same dose of ^{60}Co gamma rays) to Nuraghi and Roman remains to construct

plots, which by extrapolation gave values of the total cumulated doses in both samples. The dose cumulated in the Nuraghi remains was found to be equal to 31.0 Gy, while that cumulated in the Roman skeleton - 16.7 Gy. By a rather simple comparative calculation based on the assumption that the age of the Roman remains was, as established by archaeologists equal to 1700 years, the age of nuragic remains was evaluated as being equal to 3200 years (1200 years BC). The total error of the EPR measurements, EPR signal analyses and dose extrapolation was estimated to be 12-15%.

The crystallinity of the bone mineral in Nuraghi skeletons evaluated by the EPR technique, the method adapted earlier by some of the authors for biomedical studies on mineralised tissues, is only little changed after centuries of the deposition of Nuraghi remains in tombs, as compared with contemporary bone samples. This is an additional argument for the correctness of the EPR method adapted for the dating.

Comparison of the chemical composition of Nuraghi skeletons contaminated through percolation by rain or floods with that of contemporary bone shows an increase in the concentration of Fe, SiO_2 , Al and Ca. As expected, the contamination is minimal in tooth enamel. More details on the subject one can find elsewhere [1].

References

- [1]. Stachowicz W., Sadło J., Strzelczak G., Michalik J., Bandiera P., Mazzarello V., Montella A., Wojtowicz A., Kamiński A., Ostrowski K.: *It. J. Embryol.*, **104**, 1, 19-31 (1999).

THE CELLULOSE MEMBRANE - WATER INTERACTION STUDIED BY DIFFERENTIAL SCANNING CALORIMETRY

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Membrane processes are involved in nuclear technologies and other industries. Separation of various media on cellulose membranes is possible due to an interaction of the material of these dense membranes with solvents.

At present, the preliminary studies of cellulose membrane - water interaction were carried out applying differential scanning calorimetry (DSC). The processes like melting and crystallization of water as well as melting of the polymer phase containing



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