Samples of PTM were moistened with water solutions of poly(ethylene glycol) (PEG) 2000 type (2.5%), isopropanol, maleic acid. Some of the samples were additionally activated by using UV radiation (250 nm) or a 10 MeV electron beam at a dose of 105 kGy.

The most important results are given in Figs.1-4. In comparison with the results for a virgin membrane (Fig.1), increasing of microfiltration rate in the case of membranes moistened with isopropanol (90%), and with PEG (46%) was observed. After activation by the electron beam, increasing of microfiltration efficiency took place only for the samples treated earlier with the PEG solution (relative value 20%).

Future work in this subject should explain and develop the obtained results, which seem to be important for further application of PTMs.

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RADIATION RESISTANCE OF PARTICLE TRACK-ETCHED MEMBRANES

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Particle track-etched membranes (PTMs) can be used in many fields, first of all in biomedicine and biotechnology [1]. Because of such application it is important to have data about the radiation resistance of PTMs and the possibility of their radiation sterilization. Research in this field have been undertaken in the 90's by two co-operating institutes: the Joint Institute for Nuclear Research (JINR) in Dubna and the Institute of Nuclear Chemistry and Technology (INCT) in Warszawa [2].

Widening of the possibility of PTMs application is connected, among others, with the production of new kinds of membranes. Nowadays PTMs are manufactured of PET and PC films with a nominal thickness of 20 μm [3]. Attempts to manufacture PTM using a PEN film have been undertaken in the INCT [4]. Lack of data concerning the radiation resistance of the above polymeric films and PTMs has become a reason for doing this work.

Samples of both PTM and their base polymers have been investigated. The following PTM sample materials were prepared (see the legends of the proper Figs.): PET films of 10 and 20 μm thick (JINR), PET and PC films 20 μm thick (Whatman-Cyclopore, Belgium), PEN films 25 μm thick (irradiated at a U-400 cyclotron - JINR, etched in the INCT). The following polymeric films samples were taken: the PET film of 10 and 19 μm thick, Estrofol ET type (Nitron-Erg, Poland); the PEN film 25 μm thick, Kaladex type (ICI, UK); the PP film 20 μm thick, BG 2001 type (Petrochemia Płock, Poland).

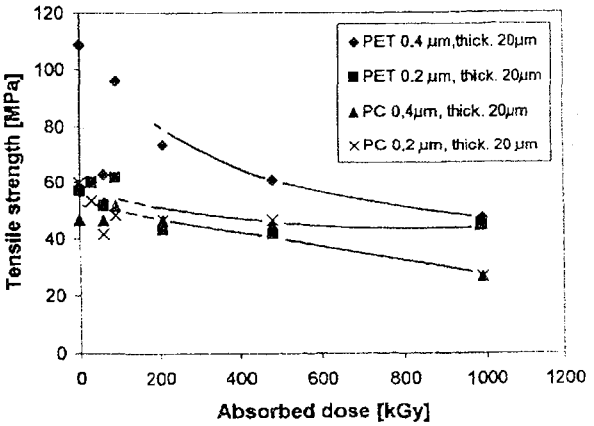

Fig.2. Tensile strength vs. absorbed dose for TEMs made of PET and PC films.

Samples of PTM and polymeric films were irradiated using an electron beam in air of 10 MeV energy. The irradiation was made at the linear

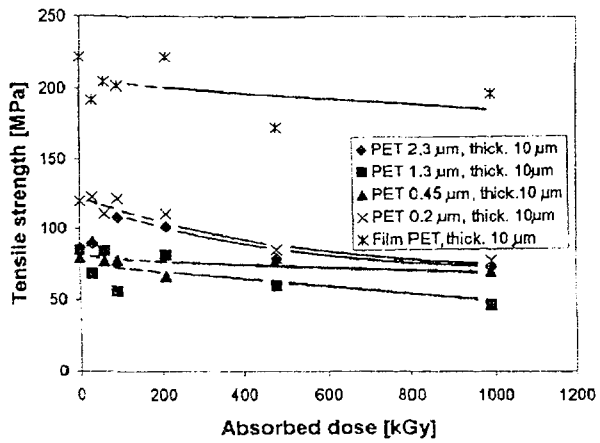

Fig.1. Tensile strength vs. absorbed dose for a PET film 10 μm thick and TEMs made of that film.

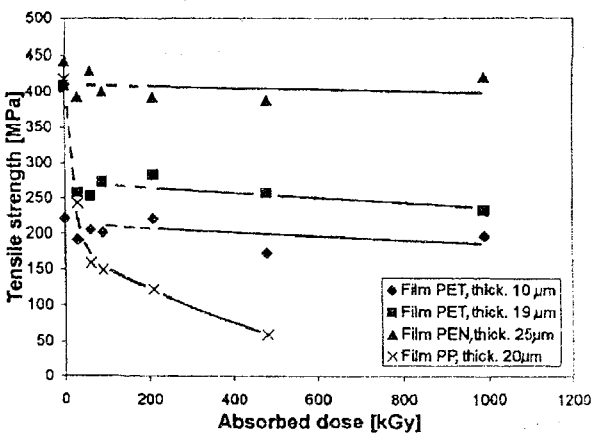

Fig.3. Tensile strength vs. absorbed dose for different polymeric films.

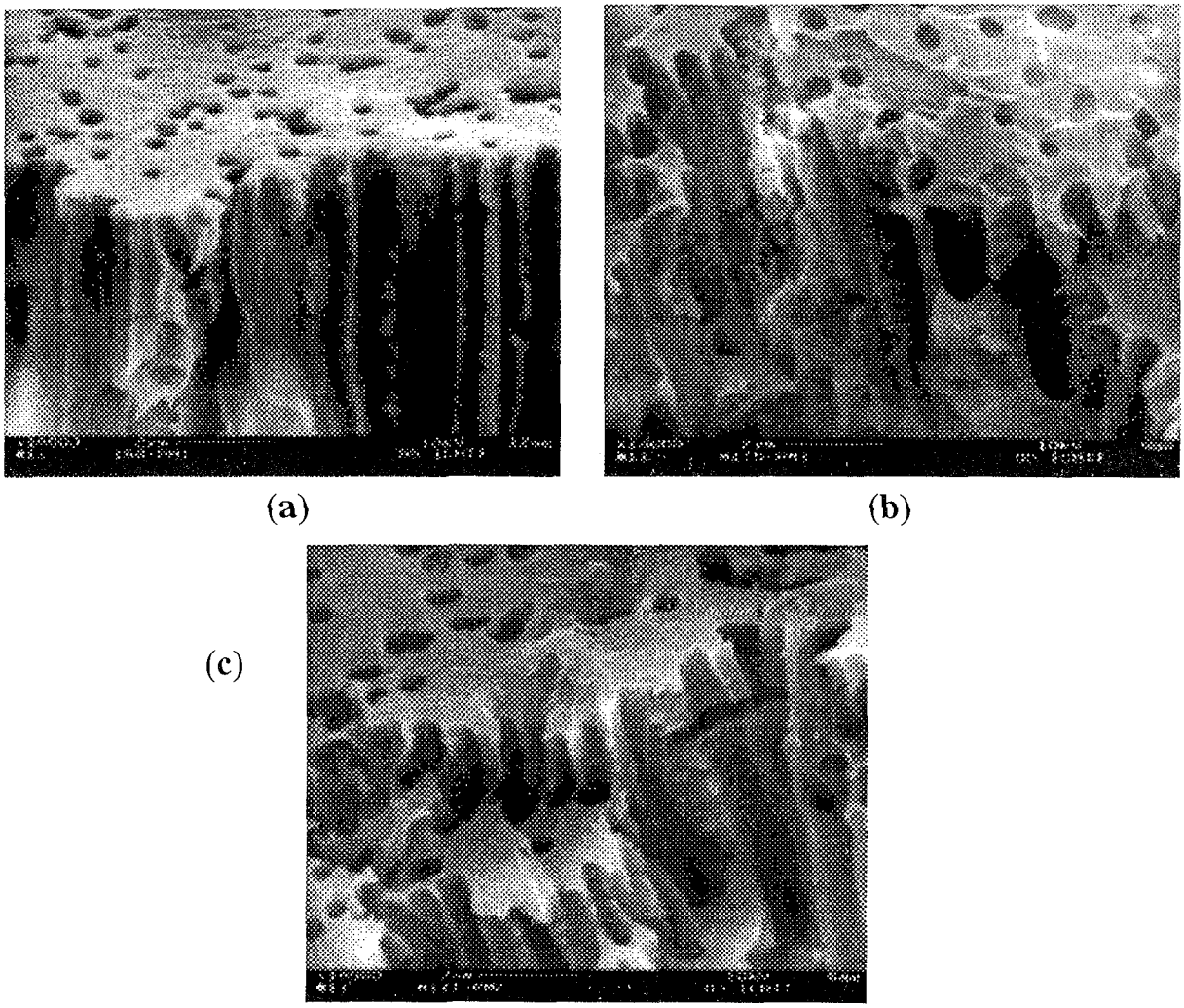

Fig.4. SEM photographs of the virgin TEM (0.4 μm pores size) made of PET film 20 μm thick (a) and irradiated to a dose of 480 kGy (b) and 990 kGy (c).

electron accelerator LAE-13/9 type that is exploited in the Department of Radiation Technology of the INCT. The doses used were in the range from 30 to 990 kGy.

The measurements were made using a simple tensile testing machine. It gave directly the value of breaking force for standard strips of the investigated materials. Results were averaged and given in pressure units.

Results concerning tensile strength vs. absorbed dose are shown in Figs.1-3 and give a comparison of the behaviour of different PTMs and films. Fig.4 shows SEM photographs of surfaces and fractured sides of PTMs samples before and after irradiation at doses of 480 and 990 kGy, respectively.

PTMs made of the PEN film are more resistant against electron irradiation than PTMs made of the PET films of similar thickness and membrane parameters (pore diameter and pore density).

In the case of PTMs (with similar porosity) made of PET 10 μm thick, the tensile strength does not practically depend on the pore diameter and slightly decreases at a dose of 990 kGy (the difference is about 30%).

In the case of membranes made of polymeric materials as PET and PC (the pore density at the same level of magnitude) but with different thicknesses (10 and 20 μm), the results concerning the tensile strength and the burst strength are similar up to the dose 990 ky.

The SEM photographs show small changes on membranes surfaces at the highest dose.

All the investigated types of PTM and films, apart from PP films, can be radiation sterilized.

For the investigation of tensile strength, the standard samples of the PTMs and polymeric films from different centres have been used. In the case of more precise measurements, it is necessary to take into account the anisotropic structure of biaxially oriented polymeric films. Moreover, it seems to be useful to carry out detailed measurements in the range up to a dose of 100 kGy because of the considerable scatter of the obtained results in the latter case.

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