of the liquid. Consequently, the rate determining steps are localised at the solid-liquid interface or in the liquid film in immediate contact with it.

The effect of the rate of stirring can be expressed by the coefficient of stirring, a, defined by the relationship: dc/dt proportional to $(r.p.m.)^a$. The average value of this coefficient was found to be 0.22 over the range investigated, *i. e.* 280—555 r.p.m. This is much smaller than the value of 0.5—1.0 generally reported for heterogeneous processes controlled by diffusion [6], indicating that chemical reactions are among the rate determining steps.

Further work is in progress in an endeavour to elucidate the reaction mechanism both in the absence and presence of inhibiting metal ions.

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Action of Ionizing Radiation on Insulating Plastics

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The action of ionizing radiation on insulating plastics is of great interest from various points of view, such as (i) the selection of most suitable materials for the construction of measuring equipment, (ii) the elucidation of the mechanism of induced conductivity and also (iii) as a model for the action of radiation on biologically important macromolecules [1,2]. By making use of a new experimental method [3] it has been possible to demonstrate that induced conductivity during beta irradiation (from Ce-Pr-144) as well as the so called aftereffects are generally very different when part of the volume only is irradiated (leaving the insulating surface completely untouched by radiation) or when directing the radiation on the insulating surface [4]. From a theoretical point of view volume effects seem more interesting but for practical purposes surface effects are sometimes very important. They are often so pronounced as to make an otherwise excellent insulator practically useless. It seemed of interest, therefore, to investigate these surface effects somewhat further.

Insulating surfaces are in most cases in contact with atmospheric air and we thought it likely that, amongst other things, the deterioration might be caused by oxidation under the action of radiation. Oxidation would be expected to lead to the formation of hydrophilic groups and, consequently, to an increase in wettability. This would tend to decrease the usefulness of any insulator as small changes of temperature will always occur and may, on a wettable surface, enable a continuous and conducting layer of water to be formed. The formation of hydrophilic groups we were able to demonstrate in several ways:

(a) Specimens of insulating plastics were exposed to gamma-radiation from a ^{60}Co source of 70 Curies and the contact angle of small drops of 0.1 N NaOH measured on freshly machined surfaces. For machining we used a tool carefully washed in benzene and alcohol, for measuring a simple device made from a microscope. The data compiled in Table 1 show a considerable decrease of contact angle (increase in adhesion [5]).

(b) The formation of hydrophilic groups can be demonstrated very easily using liquid paraffin which has been shown to undergo much the same change of properties under irradiation as does polyethylene [6]. A drop of a paraffin of standard weight put onto a clean surface of 0.1 N aqueous NaOH forms a lens with a well defined diameter [7] which increases due to increased number of hydrophilic groups as the material is irradiated by ionizing radiation (previous to putting drops onto the aqueous alkali). We used 180 kV X-rays for irradiation in this case. A series of measurements is shown in Fig. 1.

(c) The effect can also be demonstrated in another way, lending itself more easily

Table 1. Contact angles of drops of aqueous alkali on various plastics before and after irradiation.

Material	Contact angle after irradiation with		
	0 Mrad	8 Mrad	16 Mrad
Polyethylene * ("Alkathene")	85°	76°	75°
Polysterene ("Trolitul")	98°	86°	77°
Polymethylmethacrylate ("Plexiglas")	84°	72°	52°
Polytetrafluorethylene ("Teflon")	90°	86°	82°
Polymonochlortrifluor-ethylene ("Kel F")	74°	55°	50°
Polyethyleneterephthalate ("Melinex")	71°	62°	55°

* Paraffin wax was measured for comparison. A dose of 2 Mrad gave a change of contact angle from 100° to 95°.

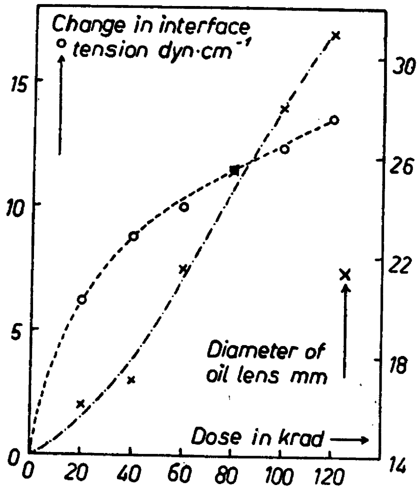

Fig. 1. Equilibrium values of interfacial tensions (24 hours) and oil lens diameters (10 mins. after surface contact). Latter values average 10 measurements. 20° C.

to quantitative evaluation, by measuring the interfacial tension between liquid paraffin and water by means of a Du-Noüy-balance (Fig. 1).

Another series of irradiations was conducted in an atmosphere of purified nitrogen admitted after prolonged evacuation of the vessels containing the specimens of plastic. Contact angles were measured by method (a) in air. They showed a decrease of the same order as had been found after irradiation in air. Though this result seems to disagree with the above explanation it must be kept in mind that irradiation of many substances in the absence of air produces long lived radicals which react with oxygen rapidly as soon as the latter becomes available [8].

The fact that the materials studied were of technical grade has to be borne in mind. This does not detract from the practical value of the results though side effects due to unspecified additions cannot be excluded.

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