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EFFECTS OF TEMPERATURE ON RADIOLYSIS OF POLYETHYLENE IN INERT AND OXIDATIVE ATMOSPHERES

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In the context of transportation, storage and final disposal of intermediate-level, long-lived nuclear wastes (ILW-LL).regarding nuclear safety, it is important to evaluate the risk related to gas release by the radiolysis of polymers (e.g. polyethylene and polyvinyl chloride).

The first aim of this collaborative work between CEA, ORANO and EDF is to examine the effect of γ-irradiation performed at different temperatures (25-150°C) under inert atmosphere for polyethylene containing various chemical defects, including C=O and C=C groups. The results (Fig. 1) confirm the "protective" role of unsaturated moieties causing a reduction of H_2 emission [1, 2], and provide new elements to discuss the mechanism of hydrogen formation under radiation [3].

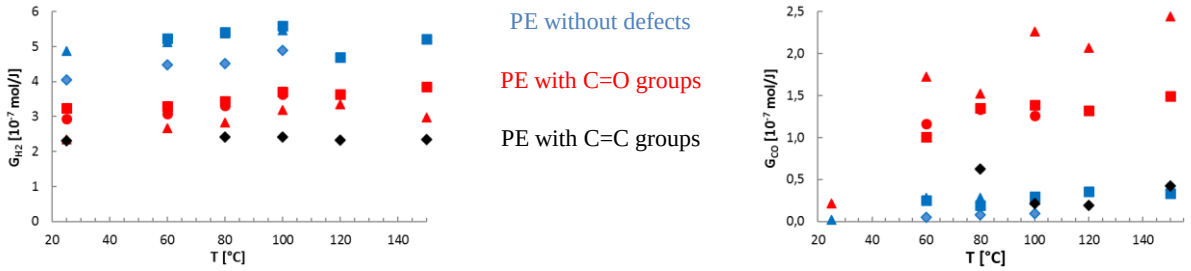

Figure 1. H_2 and CO production yields for polyethylene (PE) with or without chemical defects.

The impact of oxygen on the degradation of high-density polyethylene (HDPE) under γ-radiolysis and temperature has been also investigated. Obtained data show that the main effect of radiation consists in the reduction of the oxidation induction time (OIT) of the

polymer. The structural changes of HDPE films identified by FTIR and UV-vis spectroscopies involve the formation of C=O groups and conjugated compounds.

References:

[1] M. Ferry *et al.*, Radiat. Phys. Chem. **118**, 124 (2016).

[2] A. Ventura *et al*., J. Phys. Chem. B **120**, 10367 (2016).

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