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Towards an understanding of space charges trapping in cable polyethylene

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The presence of a space charge in the insulating material is likely to affect the behaviour of high voltage buried cables. Apart from the experimental work on this subject, an effort has been made to analyse the space charge in polyethylene (PE) by means of molecular modelling [1].

A first part of the paper briefly recalls the methodology used for our approach, using both molecular dynamics and ab initio quantum calculations [2]. A glassy phase of tridecane $C_{13}H_{28}$ has been extensively studied to predict trap depth and densities due to conformational defects of PE. Then, chemical effects due to double bonds, oxidation, additives, are also considered on an individual basis and it is shown that some of them could constitute deep traps for electrons.

By using the results obtained on conformational defects, a first attempt to predict the dynamic macroscopic behaviour of the insulator from molecular modelling is presented.

Finally, a critical analysis of our results is proposed and the guidelines for future work are given.

[1] M Meunier, N Quirke, D Binesti, G Martic, J M Fourmigue, , Conference on Electrical Insulation and Dielectric Phenomena (CEIDP) Annual Report, IEEE, pp. 68-71, 1997.