

Influence Of Mechanical Pressure On Space Charge Penetration Behavior In Low-density Polyethylene (LDPE) Sheet

A. I. Mohamed^{1*}, M. M. Saari¹, R. Ozaki², and K. Kadowaki²

¹ Fakulti Kejuruteraan Elektrik Elektronik, Universiti Malaysia Pahang

² Electrical and Electronic Engineering, Faculty of Engineering, Ehime University, Japan

*E-mail: amirizzani@ump.edu.my

Abstract – Space charge penetration into bulk of cable insulation is known as the cause of insulation breakdown thus affecting the cable power delivery capability. Penetration of packet-like positive space charge enhances local field and when the field increases up to 5 MV/cm before breakdown occurs. Exactly before the breakdown occurs, space charge penetration seems stagnant as it is prevented to penetrate further into cathode. The generated Maxwell force is assumed to press the free volume of the insulation thus reducing the size of the free volume itself. A pulsed-electroacoustic (PEA) equipment capable to press the sample up to 5 ton is developed. Sample used in this study is a 150 μm low-density polyethylene (LDPE) sheet. The sample is stressed with positive dc voltage so that the mean applied field is equal to 1.5 MV/cm. The range of pressure applied to the sample is from 0 MPa and 32 MPa. The penetration gradually reduces with the increase of pressure. Sample pressed with 32 MPa showed the least penetration depth as little as 5 % of the sample thickness. As a comparison, space charge penetration of sample with 0 MPa pressure is as depth as 85 % of the sample thickness. This shows that space charge penetration is restricted when sample is pressed. The result obtained shows that it requires at least 24 MPa to suppress space charge penetration.

Keywords: *space charge, low-density polyethylene, hvdc, transmission line*