UNIVERSITI TEKNOLOGI MARA

PLASMA SURFACE TREATED POLYVINYLIDENEFLUORIDE - TRIFLUORO ETHYLENE (PVDF-TrFE) COPOLYMER FILMS

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Thesis submitted in fulfilment
of the requirements for the degree of
Master of Science

Faculty of Applied Sciences

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CONFIRMATION BY PANEL OF EXAMINERS

I certify that a Panel of Examiners has met on 24 November 2015 to conduct the final examination of Muhamad Naiman Bin Sarip on his Master of Science thesis entitled "Plasma Surface Treated Polyvinylidenefluoride - Trifluoro Ethylene (PVDF-TrFE) Copolymer Films" in accordance with Universiti Teknologi MARA Act 1976 (Akta 173). The panel of Examiners recommends that the student be awarded the relevant degree. The panel of Examiners was as follows:

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I declare that the work in this thesis/dissertation was carried out in accordance with the regulation of Universiti Teknologi Mara. It is original and is the result of my own work, unless otherwise indicated or acknowledged as reference work. This thesis has not submitted to any other academic institution or non-academic institution for any degree or *qualification.*

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulation for Post Graduate, Universiti Teknologi Mara, regulating the conduct of my study and research.

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ABSTRACT

PVDF-TrFE films with thickness of 200 nm were produced by spin coating with solution concentration of 30 g/L and spinning rate of 1500 rpm. Surface of treated PVDF-TrFE film with pressure of 0.6 mbar at 9 minutes exposure time showed large elongated crystallite with increased average surface roughness from 3.51 nm to 9.12 nm. Meanwhile surface of PVDF-TrFE film treated with pressure of 0.3 mbar at 9 minutes exposure time showed a very fine crystal growth with average surface roughness of 5.60nm. Contact angle dropped significantly after plasma treatment. Exposure time of 9 minutes showed high reduction of contact angle (33%). Contact angle measurement returned to its original state after 5 days of treatment indicating that the surface with high surface energy was less stable. The FTIR spectrum indicated peaks at 1292, 848 and 885 cm^{-1} , which showed significant increased in intensity. These peaks represented all trans (TTTT) configurations. These showed that surface treatment had increased the presence of β-phase crystals on the surface of the treated PVDF-TrFE films. These β-phase crystals contributed to increment in the dielectric constant measurements. Dielectric constant at frequency of 10^3 Hz showed high increment from 10.5 to 17.0 with very low tan δ of 0.15. Elemental composition on surface treated PVDF- TrFE film detected group of fluorine at 695.3eV, oxygen group at 540.8eV and carbon group at range from 313ev to 263ev. Reduction of F/C ratio indicated dehydrofluorination on the surface, whilst the increased in O/C ratio suggested that plasma treated PVDF-TrFE film surface had interacted with oxygen in the environment. Thus, it is concluded that plasma treated PVDF-TrFE film with pressure of 0.6mbar and exposure time of 9 minute was the optimized film required for producing film surface with high surface energy, high surface roughness and high dielectric properties. However, immediate application after plasma treatment is highly recommended in order to prevent any surface oxidation.

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