# Highly Flexible Polymer Insulating layers Deposited by Initiated Chemical Vapor Deposition

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For successful fabrication of flexible electronic devices, organic components processed at low temperature are preferred due to their high flexibility and wide applicability to plastic substrate.[1,2] In this respect, poly(1,3,5-trimethy-1,3,5-trivinyl cyclotrisiloxane) (pV3 3) films deposited by initiated chemical vapor deposition (iCVD) were recently proposed as a promising candidate for polymer insulating layers.[3] The technique allows high-quality, ultra-thin polymer layers to be deposited in near room temperature and solventless condition, thus is applicable to virtually any kind of substrates including low-cost plastic films sush as polyethyleneterephthalate (PET).[3,4] Here, we discuss on the durability of the pV3D3 insulating layers under tensile strain and demonstrate highly flexible thin-film transistors (TFTs) using the pV3D3 layers as gate insulating layers.

The flexiblity of the 20 nm-thick pV3D3 insulating layers was tested by using Al/pV3D3/Al devices fabricated on 125 um-thick PET substrates (Fig. (a)). The devices were bent with underlying cylindrical supports of vaious radii. The pV3D3 layers maintained their excellent insulating property even for a bending radius of 1.5 mm, corresponding to a tensile strain of 4 %, and capacitance measured from the Al/pV3D3/Al devices increased as the strain increased (Fig. (b)(c)). Capacitance density, however, that was nomalized by the increased device area considering the tensile strain was almost constant for the strain of up to 2.5 % implying that the Possion ratio of the pV3D3 flim is near zero, thus the strain is uniformy distributed without being concentrated in a particular point. Flexible $C_{60}$ TFTs fabricated on PET subatrates showed virtually the same characteristics with those fabricated on glass subatrates whose field-effect mobility is about 1 cm$^2$/Vs (Fig. (d)).

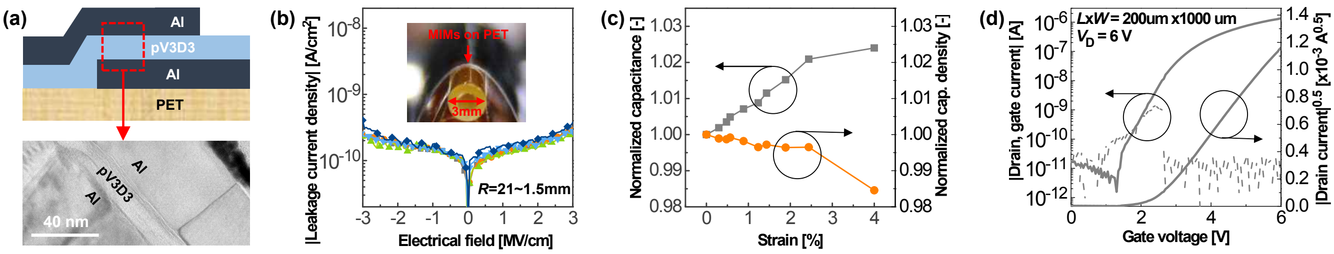


**Fig. 1. (a) Structure and a cross-sectional TEM image of Al/pV3D3/Al devices and (b) leakage current density of 20 nm-thick pV3D3 layers with various bending radii (*R*). (c) Capacitance and capacitance density normalized by the initial values with various strain. (d) The transfer curve of a $C_{60}$ TFT with a 24 nm-thick pV3D3 gate insulating layer.**

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