Degradation mechanisms of a photovoltaic device with an Al/C-60/C-12-PSV/PEDOT:PSS/ITO/glass geometry was studied using a combination of in-plane physical and chemical analysis techniques: TOF-SIMS, AFM, SEM, interference microscopy and fluorescence microscopy. A comparison was made between a device being stored in darkness in air and a device that had been subjected to illumination under simulated sunlight (1000 Wm(-2), AM1.5) in air. It was found that oxygen diffuses through pinholes in the aluminium electrode. If stored in air in the dark the oxidation is limited to the C-60 layer. Illumination accelerates the oxidation/degradation and thus expands the process to involve at least the underlying layer of C-12-PSV. Furthermore, it was found that particles are formed in the device during storage. (c) 2006 Elsevier B.V. All rights reserved.