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This investigation deals with the synthesis and detailed study on photoinitiator-free photosensitive polyimide gate insulator used for the organic thin-film transistors (OTFTs), one of the most important components of active matrix displays on plastic substrates. The photosensitive polyimide precursor, poly(amic acid) was prepared from aromatic dianhydride, 3,3',4,4'-benzophenone tetracarboxylic dianhydride (BTDA) and novel aromatic diamine, 7-(3,5-diaminobenzoyloxy) coumarine (DACM). The photosensitivity of the poly(amic acid) film is investigated using a high pressure mercury lamp at 280-310 nm. The pattern resolution of the photocured film was about 50 μm . The surface morphology of the films before and after photo-patterning process is also investigated. In addition, we have fabricated pentacene OTFTs with the photoinitiator-free photosensitive polyimide as gate insulator. The OTFT characteristics are discussed in more detail with respect to the electrical properties of the photosensitive polyimide thin film.