

ORIGINAL PAPER

Spectral characterisation of new organic fluorescent dyes with an alkoxysilane moiety and their utilisation for the labelling of layered silicates

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Received 30 March 2012; Revised 20 July 2012; Accepted 21 July 2012

Dedicated to Professor Štefan Toma on the occasion of his 75th birthday

New fluorescence dyes with an alkoxysilane moiety were synthesised by the condensation of 3-(triethoxysilyl)-1-propanamine (3-aminopropyltriethoxysilane) with 4,10-benzothioxanthene-3,1'-dicarboxylic acid anhydride (BTXA) and *N,N*-dimethylaminonaphthalene-1,8-dicarboxylic acid anhydride (DMANA), which was accompanied by the formation of an imidic bridge. The compounds *N*-(3-(triethoxysilyl)propyl)-thioxantheno[2,1,9-de]isoquinoline-1,3-dione (BTX-S) and 4-(*N'*,*N'*-dimethyl)-*N*-(triethoxysilyl)propyl-1,8-naphthalene dicarboxylic acid imide (DMAN-S) were characterised by steady-state and time-resolved fluorescence spectroscopy in chloroform and ethanol. Both conjugates (BTX-S and DMAN-S) exhibited absorption and emission bands in the same region as the un-substituted BTXA and DMANA. An important Stokes shift was observed for DMAN-S in ethanol. A high fluorescence quantum yield was observed for BTX-S in both solvents and for DMAN-S in chloroform. In addition, the newly developed fluorescent silane dyes were covalently attached to the microscopic particles of layered silicates and on the surface of SiO₂ wafers as a proof of concept for fluorescence particle (surface) visualisation. The surface wafer modification was precisely characterised by X-ray photoelectron spectroscopy (XPS). Successful covalent linkage onto the particles of layered silicates was proved by confocal laser scanning microscopy technique. © 2012 Institute of Chemistry, Slovak Academy of Sciences

Keywords: benzothioxanthene dicarboxylic acid imides, dimethylaminonaphthalene dicarboxylic acid imides, silane, neutral dyes, modification, layered silicates

Introduction

Various types of fluorescent probes with different chemical structure have been synthesised to monitor a wide spectrum of processes in a variety of envi-

ronments, such as solutions, micelles, solid inorganic, organic amorphous, or crystalline matrices (Czarnik, 1994; de Silva et al., 1997; Winnik & Regismond, 1996; Capek, 2002; Zimerman & Weiss, 1998). Despite the availability of other alternatives, silanol-coupled

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