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Dithieno[3,2-*b*:2',3′-*d*]furan as a new building block for fused conjugated systems

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Abstract
The first synthesis of dithieno[3,2-*b*:2′,3′-*d*]furan (**1**) from 3,4-dibromofuran is presented. The stability and reactivity of **1** was investigated in selected substitution and coupling reactions.

Keywords: dithieno[3,2-*b*:2′,3′-*d*]furan; fused heterocycle; electrophilic substitution; coupling reaction

Introduction

Over the past number of years, the application of electron-rich heterocyclic compounds to the fields of organic field effect transistors (OFETs), organic light emitting diodes (OLEDs) and organic photovoltaics (OPVs) has been a subject of considerable interest.[1-3] The most extensively studied materials involve conjugated systems, polymers[4] or small molecules, based mostly on oligothiophene[5-12] and fused thiophene[5,7,8,10,13,14] (thienoacene) units whose band gaps and electronic properties are able to be tuned by structural changes. Synthetic approaches aimed at the rigidification and planarization of the conjugated backbone have been developed in order to enhance π-electronic delocalization by limiting the rotational disorder between thiophene rings.[13,15] In this context, 3,3′-linked 2,2′-bithiophene building blocks of the general formula **A** (X = CH_2, CR_2, C=O),[5,6,16-18] dithienothiophene (X = S),[5,7,10,13] dithienopyrrole (X = NH and NR),[5,19] dithienosilole (X = SiR_2),[5] dithienophosphole (X = PR_3),[20,21] and others,[20,21] have been broadly studied and the strong influence of the bridging group on the electron affinity and electronic properties of the designed materials have been demonstrated (Figure 1). Theoretical studies,[21] including unknown dithienofuran (X = O),[22] that have been corroborated by experimental data have