Conjugated polymers have attracted great attention since their highly π-conjugated polymeric chains and superior electrical, optical properties.1-3 For this reason, they have been widely utilized for applications such as light emitting diodes,4 transistors,5 smart windows,6,7 and sensors.8-10 Furthermore, functional organic molecules with fluorescence properties could be attached monomers to design and synthesis of polymeric materials with spectacular optical electrical properties. These unique polymeric structures can be used in biochemical key fields such as cell imaging and sensor platforms.11-14

Fluorescent conducting polymers (FCPs) are significant class of polymers related with π-conjugated molecular systems.15,16 These polymers have the structure of molecular wire depend on the free excitation migration throughout the conjugated polymer backbone.17 Besides, they have characteristic properties such as electronic transport and energy transfer. Thanks to this features which leads to increased sensitivity and selectivity, FCPs have been of interest as sensor platforms.18 Another advantage of FCPs is properties of them can be tuned through chemical structure variation. The specific groups attached to molecule structure are very significant since they would provide the selectivity to analytes. In addition to, FCPs have structural stability, low cost and ease of response measurement.20,21 Furthermore, thin film forming features of the FCPs with electrochemical methods provide great advantages. Because their morphological properties and thickness of film can be controlled by changing applied voltage or current, they allow the formation of fluorescent surfaces with desirable properties for sensing applications.22 Rhodamine as fluorescent group, shows excellent photo physical properties such as high fluorescence quantum yields and large molar extinction coefficients.23 They alter equilibrium between nonfluorescence and fluorescence forms, providing an ideal model for the design of sensor with light “off-on” switching.24

Considering the quite limited research on conducting fluorescent polymers, the design and synthesis of new fluorescent polymers that show both better electrochemical, optical and fluorescent properties are still necessary and important. Herein, we studied on the design of new material that demonstrated both electrochromic and fluorescent properties. For this purpose, we synthesized new fluorescent monomer which containing carbazole and rhodamine group (RDC). Electrochemical, spectroelectrochemical and fluorometric properties of RDC were successfully investigated. Its’ solid state electrochromic and fluorescent properties are excellent candidates for application as layers in optoelectronic devices and fluorescent sensors.

**Experimental**

**Materials.**—All chemicals are standard analytical grade. Rhodamine B, phosphoryl chloride, acetonitrile (ACN), 2-Hydroxycarbazole, magnesium sulfate (anhydrous), tetrabutylammonium hexafluorophosphate (TBPF6) and dichloromethane (DCM) were purchased from Sigma Aldrich. Indium tin oxide (ITO) glass obtained from Delta Technologies was used as working electrode with surface resistance of 8–12 Ω sq⁻¹ and a thickness of 7 × 50 × 0.5 mm.

**Apparatus.**—Electrochemical deposition and electrochemical characterizations were carried out on Ivium stat potentiostat/galvanostat. Spectroelectrochemistry experiments were performed using combination of Iviumstat potentiostat/galvanostat and an Agilent 8453 UV-vis spectrophotometer. 1H-NMR spectra were recorded on a 400 MHz/54 nm Ultra Shield plus spectrometer using deuterated DMSO as solvent and tetra methyl silane as internal reference. An FTIR spectrum was performed using Perkin-Elmer 2000 FTIR spectrophotometer (4000–400 cm⁻¹) with its Universal ATR Polarization. For surface characterization, a Carl Zeiss (Supra 40 VP) model Field Emission Scanning Electron Microscopy (FESEM) was used. Fluorometric measurements were performed using Varian Cary Eclipse fluorescence spectrophotometer. An Olympus CKX41 model inverted microscope equipped with a DC30 camera was performed to investigate fluorescence image of polymer. Minolta CS-100 Chromameter was used to colorimetry measurements of conducting polymer film.

**Synthesis of RDC.**—To a stirred solution of rhodamine B (1.0 g, 2.1 mmol) in dry dichloromethane (15 ml), (0.24 ml, 2.1 mmol) phosphorus oxychloride was added under inert atmosphere conditions. The solution was refluxed for 4 h and after removing solvent under vacuum, acid chloride was successfully obtained. The obtained crude acid chloride was dissolved in ACN (10 ml). Then mixture of 2-Hydroxycarbazole (0.38 g, 2.1 mmol), triethylamine (1 ml, 6.3 mmol) and ACN (10 ml) was added dropwise to acid chloride during 30 min. After refluxing for 4 h, the solvent was removed under reduced pressure and purple violet solid precipitate was obtained. The water was added to this precipitate, and aqueous phase was extracted 3 times with dichloromethane (15 ml). The organic phase was washed with water and dried through anhydrous MgSO4, then filtered. RDC was obtained in yield of 6% 86. Melting point of this new monomer was 175°C. Synthesis scheme of RD-CZ is demonstrated in Scheme 1. Structure of the RDC was confirmed using 1H-NMR and FTIR spectroscopy.

**Electrochemical polymerization.**—All electrochemical experiments and electropolymerizations were performed using an Ivium-stat potentiosstat/galvanostat in a one-compartment cell.