

# Elastic composite photo-chromatic sensors with micro and nano mixed valence inorganic fillers

Kledi Xhaxhiu<sup>1</sup>

Pia Damlin<sup>2</sup>

Carita Kvarnström<sup>2</sup>

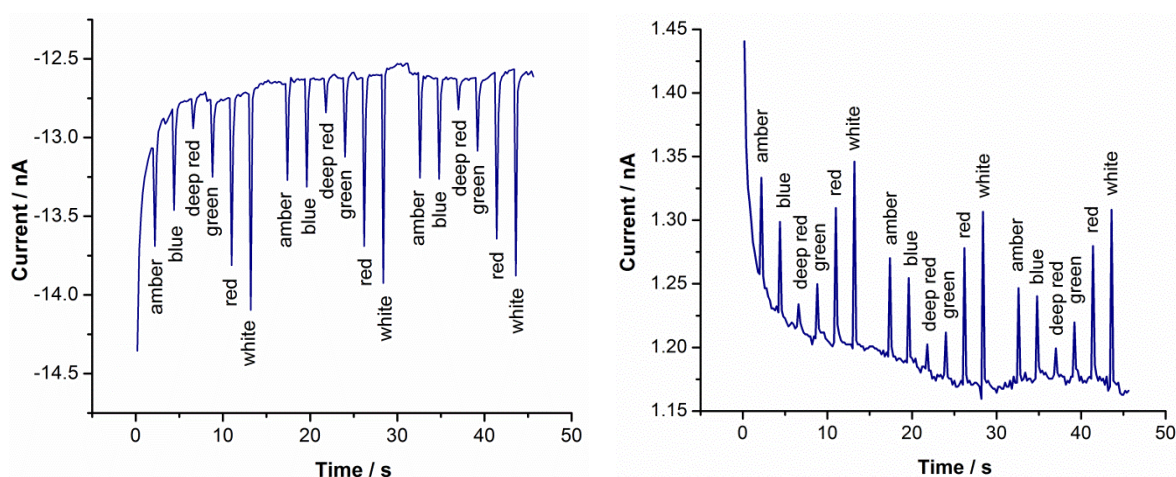
<sup>1</sup>Department of Chemistry, Faculty of Natural Sciences, University of Tirana, Blv. Zog I, No. 25/1, 1001 Tirana, Albania

<sup>2</sup>Department of Chemistry, University of Turku, Faculty of Mathematics and Natural Sciences, Vatselankatu 2, 20014 Turku, Finland

[kledi.xhaxhiu@fshn.edu.al](mailto:kledi.xhaxhiu@fshn.edu.al)

## Abstract

Two types of sandwich polyazulene-composite thin films are in focus of this research. Distinguishable changes between pure polyazulene and composite associate their in-situ cyclic voltammetric measurements revealing shifting and appearance of extra oxidation/reduction effects as well different current jumps involved in each polymerisation process. Post syntheses FTIR measurements show the existence of extra bands located at  $772\text{ cm}^{-1}$ ,  $946\text{ cm}^{-1}$ ,  $1568\text{ cm}^{-1}$ , along with those belonging to the polymer and the inorganic fillers. Under a bias of 3V, polyazulene films respond better to white (5500 K) and red (623 nm) light, followed by amber (590 nm) and blue (460 nm) light, with the highest response for white light. Targeted tuning of the inorganic filler composition, substituting two sulfur positions in the structure of  $\text{In}_5\text{S}_3\text{Se}_2\text{Cl}$  with selenium, leads to a sandwich composite polymer with reverse photo-switching response compared to polyazulene film (fig. 1). Polyazulene thin film displays negative intensities upon amber light illumination and positive ones for green and red light. The sandwich composite film of polyazulene- $\text{In}_5\text{S}_3\text{Se}_2\text{Cl}$  display positive intensities upon these three monochromatic lights, while the sandwich composite film polyazulene- $\text{In}_5\text{SSe}_4\text{Cl}$  reacted oppositely to polyazulene film toward the selected illumination wavelengths.



**Figure 1:** I-t curves recorded upon pulsed monochromatic light (exposure time of 0.01 s) with a frequency of 1000 Hz and density power of  $70\text{ mWcm}^{-2}$ , in absence of bias for: (a) polyazulene film, (b) sandwich composite film polyazulene- $\text{In}_5\text{SSe}_4\text{Cl}$