

## **Light-controlled resistance modulation in a Photochromic diarylethene -Carbon nanotube Blend**

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Abstract ;

Carbon nanotubes (CNTs) play a relevant role in the scientific community for almost two decades because of their intriguing fundamental properties, but a spread technological application is still missing.[1] One of the main reasons affecting CNT practical use concerns the difficulty to transfer individual CNT properties to easy-processable random network composed of millions of elements with different chiralities and without any preferential spatial arrangement. Until the sorting and positioning methods will remain unaffordable, the possibility to obtain opto-electronic response from 'raw' material is an attractive open challenge.

On the other hand, photochromic molecules are a broad class of compounds able to reversibly transform between two isomeric forms characterized by two different absorption spectra. The transformation is induced, at least in one direction, by the absorption of an electromagnetic radiation. The change of the molecular structure even affects other related physical-chemical properties such as HOMO and LUMO energy levels, refractive index, dipole moment, etc. In principle, the light-triggered switching of molecular properties may be exploited to control the properties of other components linked with the photochromic moiety. Unfortunately the modulation of electrical properties, even in the simple case of using photochromic molecule to directly bridge a network of conductive particles (nano-metric or macroscopic), is not trivial and just very few successful examples have been reported.[2-4]

In the current work we demonstrate reversible, light-controlled conductance switching of devices based on photochromic diarylethene polymer – raw CNTs blend. Supported by electrical and spectroscopic evidences, we argue the electrocyclic isomerization, experienced by the polymer under UV -Vis illumination, affects the inter-tube charge mobility resulting in a dramatic overall resistance variation. Differently from previous literature, based on single molecule approach,[5-7] we use simple 'wet-chemistry methods' to obtain an organic film with sheet-resistance approaching 300%, good thermal stability and remarkable fatigue resistance at room conditions.

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