Universidad Carlos III de Madrid

OO/UC3M/45- CHARACTERIZATION AND APPLICATIONS OF NEW ELECTROCHROMIC AND SUSPENDED PARTICLE DEVICES

GDAF (Displays and Photonics Applications Group) in Electronics Technology Department at University Carlos III de Madrid research on electrochromic and suspended particle devices.
It offers the characterization, the search for applications and design and implementation of optimized electronic control systems.
These devices are used in smart windows and mirrors, optical communications, ophthalmic filters…
The advantages are mainly the power consumption and easiness of switching. Specific advantages arise in each application.
Companies or institutions are searched that develop these devices, in order to establish collaboration about characterizations and control systems optimization.

Description and special features

Electrooptic devices change their spectral transmittance (color) when an electrical voltage is applied on them. The accurate control thus obtained, even linear, allow their use in applications where the transmission of light is relevant: domotics, optical communications, ophthalmic lenses, displays…
Using this effect several types of materials can be found: liquid crystal, electrochromics, suspended particles, electrophoretics, e-ink, etc.
Electrochromic materials change their properties with an electrochemical redox reaction. Suspended particles devices modify the orientation of their microballs allowing the light crossing them.

GDAF has developed two main research lines:

- A complete characterization protocol with:
  - Spectral transmittance while switching the device.
  - Response times measurement.
  - Cyclic voltammetry (current-voltage curves).
  - Electrochemical impedance spectroscopy.
  - Fitting of an equivalent circuit to these measurements.
- Development of applications such as:
  - Smart Windows electronic control systems.
  - Ophtalmic filters electronic control systems.
  - Electronic control systems for Variable Optical Attenuators in optical communications links.

IMSERSO (from Spanish Ministry of Social Affaires) and FUNDALUCE (Fundación Española de Lucha contra la Ceguera) have fund Projects for electrochromic ophtalmic glasses.

Innovative aspects

The versatility of materials, their organic type (polymeric conductors), the low current consumption, and the memory effect of many electrochromic materials are advantages of them.
For instance, low DC voltages are enough to switch an electrochromic device (under 5V).

Competitive advantages

The interest for any company taking part of electrooptic technology would lead it to offer low consumption products, environmental caring products, because electrochromic smart windows suppose a 35% of energy saving in a building, or because their memory effects. A new market in ophthalmic lenses or e-paper would also be opened.

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Technology Keywords
Optical materials; Plastics, polymers; Optic systems and webs; Thermal isolation, building energetic efficiency; Optical technology for measurements.

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