LEONARDO

PATENT BROCHURE

PROCESS FOR REALIZATION OF POLYMERIC MATERIALS WITH SECOND ORDER NONLINEAR ELECTRO-OPTICAL PROPERTIES AND ELECTRO-OPTICAL DEVICES MADE WITH SAID MATERIAL

Main Technological Area ⟶ Materials

Keyword ⟶ Cromophore | Polymers | Non linear optics

The patent concerns the process for realization of polymeric materials with second order Non-Linear Optical (NLO) properties and electro-optical devices made with said material. Polymeric chromophores, which can be crosslinked and simultaneously or subsequently poled to obtain materials with NLO activity comparable to that of lithium niobate while maintaining considerable time stability.
NLO materials have the property of modifying their refractive index when exposed to light by varying an electric field applied to them.
The embodiment in question can be obtained at substantially low costs, both in terms of production costs and in terms of operation costs.
A substantially simple to obtain, safe and reliable polymeric material with non-linear electro-optical properties of the second order is thus obtained and can be used.

With these materials it is possible to realize EO devices (Electro-Optical) like phase/amplitude/frequency modulators, commutators, commutator matrices, etc. for digital or analogue optical transmissions and processing, as an alternative to the usage of classical inorganic electro-optical substrates such as LiNbO3, InP, or GaAs.

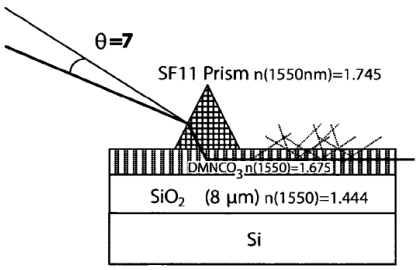

Figure 1 - Measure diagram of scattering losses

TECHNICAL SPECIFICATIONS

The process for the realization of polymeric materials with second order Non-Linear Optical (NLO) properties comprises the following steps:

- Mixing of a chromophore with nonlinear optical properties with two or three reactive hydroxy groups in an isocyanate not reactive solvent containing an isocyanate compound with at least two isocyanate groups, in order to obtain one or more bi- or tri-isocyanate NLO chromophores.
- Dissolution of the bi- or tri-isocyanate NLO chromophore together in one or more reactive solvents having catalytic properties such as consisting of acyl-substituted or unsubstituted formamides or acylamides bearing as nitrogen substituents, independently, one or more hydrogen atoms, one or more alkyls substituted or unsubstituted with isocyanate moiety not reactive groups, one or more phenyl groups substituted or unsubstituted with isocyanate moiety not reactive groups.
- Coating of a thin layer of said prepolymer mixture on a substrate.
- Cross-linking and poling of the layer deposited on the substrate.
- Cooling the cross-linked at room temperature maintaining the applied poling electric field.
- Switching off of the poling field.

INNOVATION/ADVANTAGES

- Simple and reliable production process
- Low production and operation costs
- Remarkable temporal stability
- Advantages compared to classic inorganic electro-optic substrates such as LiNbO3, InP, or GaAs.

There are great expectations for the evolution of these applications, similar to what already experienced in microelectronics with the transition from the use of technologies based on inorganic substrates to plastic materials (so-called printed circuits) that have led to a reduction in investment and production cost.

FIELDS OF APPLICATION

Signal Processing for Radar & Comms	Optical processing of RF signals (Radar, EW, Comms) Digital data exchange in the optical domain
E/O Sensor	Chemical/Biological sensing, based on Electro-Optic effects on materials
Solar power conversion	Improvement of the absorption of incident energy in photovoltaic panels, with consequent increase in efficiency

PATENT INFORMATION

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Active worldwide applications

Italy - IT1407966; filing date: 22/12/2011; grant date: 23/05/2014
EPO - EP2468784B1; filing date: 16/12/2011; grant date: 22/03/2017
National Extensions: Germany - France – United Kingdom – Sweden

USA - US8722316; filing date: 21/12/2011; grant date: 13/05/2014
Corea - 10-1604879; filing date: 21/12/2011; grant date: 14/03/2016
India - 3752/DEL/2011; filing date: 21/12/2011; grant date: ---(pending)---

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