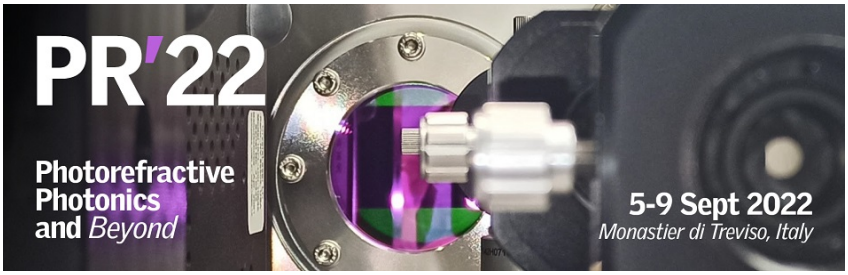


Contribution ID: **20** Type: **Invited Talk**

# Solution-deposited $BiFeO_3$ films: Photovoltaic effect & electro-optic response in dependence of doping & substrate stress

*Tuesday, 6 September 2022 16:55 (35 minutes)*

Perovskite-structured bismuth ferrite ($BiFeO_3$, BFO) is one of very few 'true' multiferroic single-phase materials with both ferroelectric and antiferromagnetic ordering. With a Curie temperature above 1000 K, it is also a prime candidate for high-temperature applications. Photovoltaic conversion efficiencies of more than 10% were reported for above-bandgap illumination in epitaxial BFO films. However, domain walls are essential in this phenomenon; it is interface-dominated and not a 'bulk' photovoltaic effect. Photorefractive properties are suppressed by high dark conductivity, which makes it difficult to achieve fully polarized samples and limits the space charge field that can be obtained under illumination.
Here, we present highly (001)-textured polycrystalline BFO films prepared by spin-coating. Doping with Mn strongly reduces leakage current, resulting in properties rivalling those of epitaxial films. At the same time, light-induced charge transport at sub-bandgap photon energies is drastically increased by Mn-doping. Evidence is presented that this charge transport is a true bulk photovoltaic effect, the first such demonstration for a solution-deposited polycrystalline film. A variation of the substrate material creates different mechanical stress states in the films, which in turn modify the photovoltaic response. This phenomenon is based on an intrinsic piezo-photovoltaic effect rather than extrinsic domain-wall phenomena. An electrooptic effect can be observed and quantified in the polycrystalline films by a modified Teng-Man setup, but it is notably lower than that seen in BFO single crystals. Combining the information on light-induced and dark charge transport and the electrooptic properties, the suitability of the solution-deposited films for photorefractive investigations is assessed.

**Primary authors:** Mr BLÁZQUEZ MARTÍNEZ, Alfredo (Luxembourg Institute of Science and Technology); Mr ARUCHAMY, Naveen (Luxembourg Institute of Science and Technology); Dr GLINSEK, Sebastjan (Luxembourg Institute of Science and Technology); GRANZOW, Torsten (Luxembourg Institute of Science and Technology (LIST))

**Presenter:** GRANZOW, Torsten (Luxembourg Institute of Science and Technology (LIST))

**Session Classification:** Materials micro- and nano-engineering

**Track Classification:** Novel photorefractive and hybrid materials