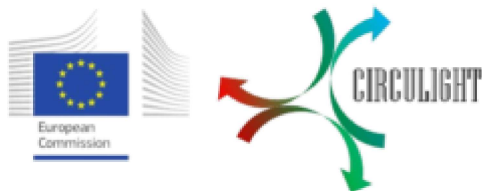


Editorial : this newsletter is published by the Circulight consortium on a biannual basis to inform you of the project's original scientific results and to popularize the underlying developed technology.



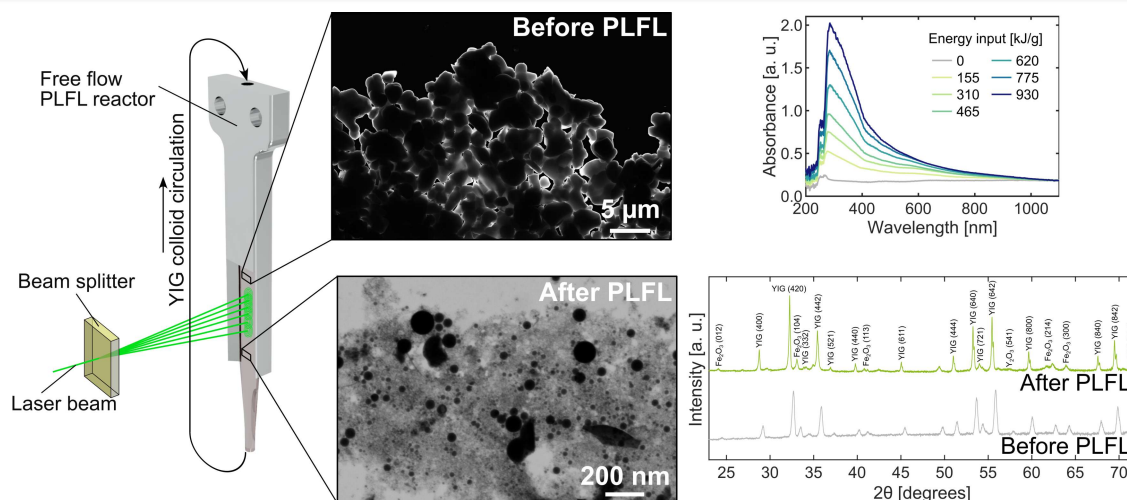
CIRCULATING LIGHT ON ANY PHOTONIC PLATFORM

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No101129645

This 3rd edition highlights two key technologies driving progress within the CIRCULIGHT project: pulsed laser fragmentation in liquids (PLFL) and sol-gel processing. Both are central to developing the magneto-optical nanomaterials used in our photonic circulator prototypes. By tailoring nanoparticle properties and integrating them into advanced matrices, these methods enable the performance and scalability required for next-generation optical systems.

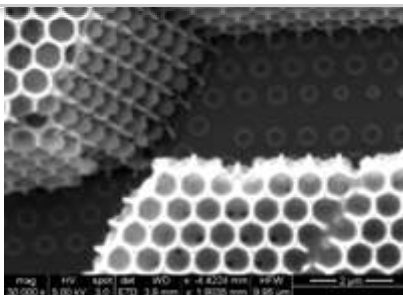
Engineering MO-Active Nanoparticles with PLFL for CIRCULIGHT Applications:

The nanoparticles (NPs) incorporated in the gel matrix govern the performance of the proposed circulator in the scope of CIRCULIGHT. Their magneto-optical (MO) activity promotes different optical confinements of each coupled mode, and is defined by the NP size, stability, and crystal structure. Characterized by its versatility, sustainability, and controllability, pulsed laser fragmentation in liquids (PLFL) stands out as a cutting-edge technology to synthesize NPs with tailored properties. PLFL is thus employed to produce MO-active Y₃Fe₅O₁₂ (YIG) NPs. Briefly, PLFL is based on the successive size reduction of nano-/microparticles dispersed in a solvent upon exposure to high-intensity laser pulses. Indeed, current findings prove that PLFL yields highly stable YIG NPs with preserved garnet phase and within the targeted size range of a 4 to 20 nm. Furthermore, it is found that controlling the laser energy dose represents a facile method to tune the NP size, and consequently, the MO activity. After approaching the g/h synthesis scale, upcoming efforts will be dedicated to dope the YIG NPs with Ce for further increased MO activity.

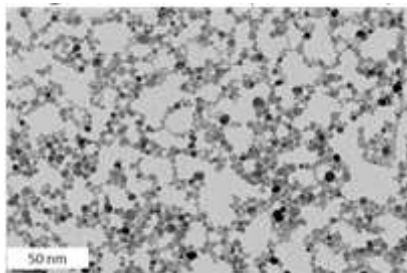


Sol-Gel Processing for Magneto-Optical Nanocomposites in Photonic Applications

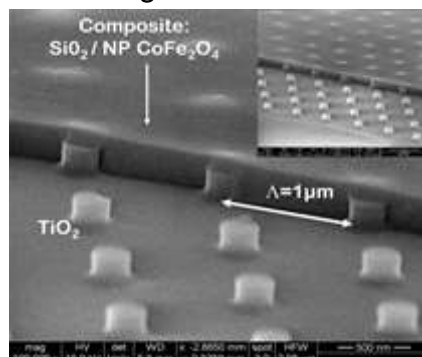
The sol-gel technique is based on the use of liquid precursors of metallic oxide, such as SiO_2 . It stands out as a versatile method for producing high-performance functional materials, especially for optical and magneto-optical applications. A key advantage is the possibility to dope the sol-gel solution with solution of nanoparticles, enabling the integration of tailored optical or magnetic functionalities at the nanoscale. These nanoparticles—such as Cobalt Ferrite CoFe_2O_4 or Yttrium Iron Garnet $\text{Y}_3\text{Fe}_5\text{O}_{12}$ (YIG) 10 nm nanocrystals—can be uniformly dispersed throughout the matrix resulting from the sol-gel transition, ensuring consistent and tunable magneto-optical responses. The process also allows to impregnate submicronstructures or coatings with these active nanocomposites, enhancing light-matter interaction. This is particularly valuable for the development of Faraday rotators, optical isolators, and magneto-optical sensors. The sol-gel process supports the fabrication of transparent thin films with high optical quality and controlled refractive indexes. By adjusting the type, size and concentration of dopant nanoparticles, specific optical properties can be engineered with precision. Additionally, sol-gel processing is compatible with large-area coatings and complex geometries. It enables low-temperature synthesis, preserving the functionality of delicate nanoparticles. As a result, the sol-gel method offers a powerful platform for designing advanced magneto-optical functional materials for integrated photonics and next-generation optical devices.



3D inverse opal obtained by impregnation by the solgel nanocomposite of a close packed 3D polystyrene balls



TEM image of CoFe₂O₄ NPs



Impregnation by the solgel nanocomposite of a 2D TiO₂ nanopillars

Mark Your Calendars!

- Come meet us at **E-MRS spring 2026**. Updates coming on our website and LinkedIn!

Follow us and find out more down below :

LinkedIn

[Subscribe](#)

[Past Issues](#)

[Translate ▼](#)

Our On-Screen Webinars

[View email in browser](#)

[update your preferences](#) or [unsubscribe](#)

