



HAL
open science

Controlled chemical solution deposition of functional ceramics inside the core of glass fibers

P Thomas, J Jouin, E de Sousa, Frédéric Gérôme, B Debord, T Billote, F Benabid

► **To cite this version:**

P Thomas, J Jouin, E de Sousa, Frédéric Gérôme, B Debord, et al.. Controlled chemical solution deposition of functional ceramics inside the core of glass fibers. 26th International Congress on Glass, Jul 2022, Berlin, Germany. pp.P309. hal-03720519

HAL Id: hal-03720519

<https://hal.science/hal-03720519>

Submitted on 12 Jul 2022

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Controlled chemical solution deposition of functional ceramics inside the core of glass fibers

P. Thomas^{1*}, J. Jouin¹, E. De Sousa¹, F. Gerome², B. Debord², T. Billote², F. Benabid²

¹ IRCER-UMR 7315, Centre Européen de la Céramique, 12 rue Atlantis, 87068 Limoges Cedex, ² GPPMM Xlim-UMR7572, University of Limoges, 123 avenue Albert Thomas, 87060 Limoges Cedex

*philippe.thomas@unilim.fr

In order to optimize the use of HCPCFs (Hollow-Core Photonic Crystal Fibers) in a number of applications [1], their core are filled with a given gas that for an ultra-enhanced interaction an incident laser beam. One challenge in gas-filled HCPCF is to control physio-chemical interaction between the gas medium and the silica inner-surface of the fiber core-surround. Depending on the gas chemical composition, several surface effects can occur such as atomic adsorption or gas-diffusion through the silica. Moreover, in some applications, laser beams with extremely high power are guided in HCPCF. Increasing the optical power handling of HCPCF require a surface material with laser induced damage threshold larger than silica.

These problems gave rise to a first series of experiments whose goal was to achieve a non-porous deposit in order to contain the gas inside the fiber by preventing its adsorption. The first results, measured on fibers treated with a nanometric aluminosilicate layer and filled with rubidium vapor, show that this layer considerably improves the lifetime of the gas from a few days to more than a month [2].

This work will focus on the processing of ceramic coatings with different compositions inside hollow-core fibers with complex microstructures. It is indeed possible to form a thin, dense, inorganic and amorphous layer with the desired properties. To obtain such a result, several parameters must be controlled, including the concentration of the solution, the technique and the deposition time, as well as the heat treatment undergone by the fiber. The properties of coated fibers are presented.

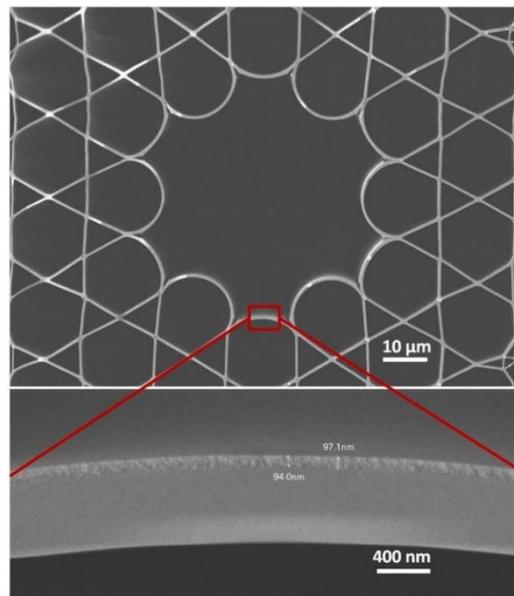


Figure 1. Thin aluminosilicate deposition inside the inner core of a Kagome HC-PCF.

References

- [1] B. Debord, F. Amrani, L. Vincetti, F. Gérôme, F. Benabid, *Hollow-core fiber technology: The rising of "gas photonics"*, *Fibers*, 7(2), **2019**, 16(58p).
- [2] T. D. Bradley, J. Jouin, J.J. McFerran, P. Thomas, F. Gerome, F. Benabid, *Extended duration of rubidium vapor in aluminosilicate ceramic coated hypocycloidal core Kagome HC-PCF*, *Journal of Lightwave Technology*, 32(14), **2014**, n°6785966, 2486-2491.