

## Low temperature post processing of hollow-core photonic crystal fibers

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HCPCFs (Hollow-Core Photonic Crystal Fibers) are used in many applications [1] in which their inner core is functionalized with a given gas to strongly enhance the interaction with a laser beam. In such devices, a key challenge is to control the physio-chemical interaction between the gas medium and the silica inner-surface of the fiber core-surround. Indeed, depending on the gas chemical composition, several surface effects can occur such as atomic adsorption or gas-diffusion through the silica material. Moreover, delivery of intense laser beams in HCPCF with further increase of their optical power requires a surface material with laser induced damage threshold larger than silica.

One solution is to post-process the HCPCF after their fabrication in order to protect the inner walls of the core from the gas adsorption and increase their resistance. Different chemical compositions were previously tested, among which a nanometric aluminosilicate layer able to improve for example the lifetime of a rubidium vapour from a few days to more than a month [2]. With this approach the deposition of a thin, dense, inorganic and amorphous layer with the desired properties have been successfully obtained. However, although the curing temperature of the samples is relatively low for ceramic compounds, it is still too high to keep the outer mechanical polymer coating of the fibers. Then, after such thermal treatment, the post-processed fiber samples are less flexible, more fragile, and it limits their size and potential use.

In this context, this work was dedicated to the decrease of the curing temperature of the inner coatings of HCPCF with complex microstructures in order to maintain their mechanical outer coating and keep their original flexibility. To obtain such a result, the compositions of the solutions were designed to ensure a low temperature removal of the organics and the thermal treatment was adapted. Additionally, the concentration of the solution and coating technique are still key parameters to ensure the deposition of a thin, continuous and amorphous layer.

### References

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