Hollow Core Microstructured Optical Fibers (HCMOFs) enable single mode guidance with large mode field diameters. HCMOFs can be applied for chemical sensing by filling the hollow core with appropriate analytes. We demonstrate preparation approaches for square shaped and hexagonal HCMOFs with a core diameter up to 30 μm. The prepared HCMOFs show a minimum loss of 3 dB/m and effective single mode propagation in the wavelength range 270 nm – 1500 nm. The HCMOFs are manufactured with very thin web bridges, typically 300 nm – 340 nm. We report on a preparation technique without supporting tubes to manufacture extremely thin bridges. The key is an intermediate cane drawing step. We show that the composition of the gas inside the preform cavities influences strongly the composition profile of the glass bridges by diffusion effects. As an example it is shown, that the OH concentration of the “dry” starting material Heraeus F300 can be shifted to over 1000 wt. ppm using a water saturated core cavity atmosphere during the fiber drawing step. This high OH concentration of the bridge silica is advantageous for RAMAN probe fabrication due its low RAMAN scattering tendency.

**OH Diffusion into the bridges**

Simulation parameter:
- wall thickness w = 500nm
- drawing speed \( \nu_i = 20 \) m/min
- draw temperature \( T_{draw} = 1900 \) °C
- OH saturation in \( t_b = 0.15 \) s

\[
\frac{\partial [\text{OH}]}{\partial z} = \frac{D}{w} \left( \frac{\partial^2 [\text{OH}]}{\partial z^2} \right)
\]

**OH enrichment during drawing: Experimental results**

Starting with Silica Heraeus F300:
- [OH] = c<0.2 ppm
- H₂O-supersaturation by H₂O₂-torch-treatment
- [OH] = 1020 ma. ppm
- Equilibrium H₂O partial pressure:
  - \( p_{H_2O} = 62.8 \) kPa
- Dew point: DP = 877 °C

**Spectral Light Propagation and RAMAN scattering**

Spectral distribution of the loss of the core mode. Except at the strand resonances, an almost constant loss of 3 dB/m (indicated by the horizontal blue dashed line) was measured for all transmission windows. The vertical dashed green lines indicate the spectral location of the silica strand resonances (green numbers are the respective resonance order) assuming a thickness of 320 – 320 nm. [3]

References