

Functionalizations of microfabricated alkali vapor cells - tailored solutions for specialized tasks

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The aim of our work is to develop application-specific functionalizations for alkali vapor cells employed in optically pumped magnetometers (OPMs). Those OPMs are used as magnetic field sensors for e.g. geomagnetic, geophysical, and biomagnetic applications as well as for fundamental research. Depending on the measurement task at hand, these cells for OPMs require specific characteristics and hence tailored functionalizations realized by thin-film technology. Therefore, we need to adjust the alkali cell's properties by their geometrical design, functionalized surfaces, and buffer-gas pressure.

Microfabricated cells enable a wafer-scale process and compatibility with standard thin-film processes. In order to realize the required characteristics of microfabricated alkali vapor cells, different features are deployed including transparent electrical heaters, lifetime-improving layers [1], anti-reflective coatings as well as optical mirrors [2]. Those features will be presented on examples of microfabricated alkali vapor cells for OPMs with different designs.

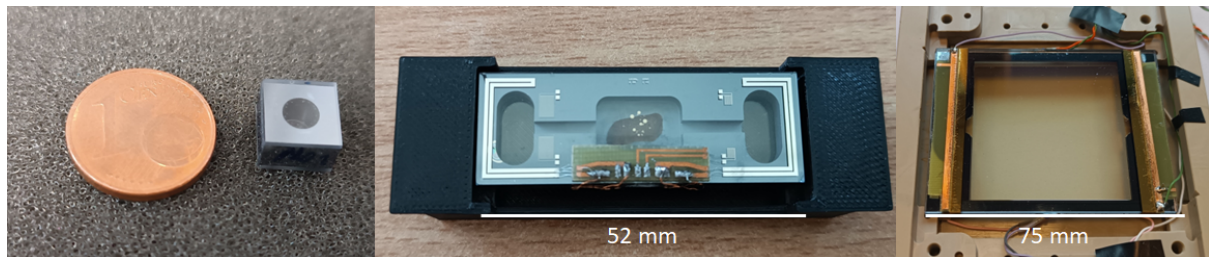


Figure 1. Examples for different cell designs with different kinds of functionalizations.

[1] S. Woetzel et al, Lifetime improvement of micro-fabricated alkali vapor cells by atomic layer deposited wall coatings, *Surf. Coat. Int.* **221**, 158 (2013).

[2] F. Wittkämper et al, Integration of Passivated Gold Mirrors into Microfabricated Alkali Vapor Cells, *Coatings* **13**, 1733 (2023).