EGU23-5828, updated on 25 Apr 2024
https://doi.org/10.5194/egusphere-egu23-5828
EGU General Assembly 2023

Development of a high-finesse broadband optical cavity using prism based on total internal reflection for applied spectroscopy

Ruyue Cui[1,2], Gaoxuan Wang[1], Azer Yalin[3], Lingshuo Meng[1], Cécile Coeur[1], Lei Dong[2], and Weidong Chen[1]

[1]Laboratoire de Physicochimie de l'Atmosphère, Université du Littoral Côte d'Opale, Dunkerque 59140, France
[2]State Key Laboratory of Quantum Optics and Quantum Optics Devices, Institute of Laser Spectroscopy, Shanxi University, Taiyuan 030006, China
[3]Department of Mechanical Engineering, Colorado State University, Fort Collins, CO 80523, USA

The use of high reflectivity dielectric mirrors to form a high finesse optical cavity allows one to achieve long optical path lengths of up to several kilometres for high-sensitivity spectroscopy applications [1,2]. The high reflectivity of a dielectric mirror is achieved via constructive interference of the Fresnel reflection at the interfaces produced by multilayer coatings of alternate high and low refractive index materials [3]. This wavelength-dependent coating limits the bandwidth of the mirror's high reflectivity to only a few percent of the designed central wavelength.

We report on the recent development of a novel optical cavity based on prisms as cavity reflectors [4-6], which offers a high-finesse optical cavity operating in a broadband spectral region from 400 to more than 1600 nm [7] and provides a very suitable high-sensitivity spectroscopic technique for frequency-comb application.

Acknowledgments : This work is supported by the French national research agency (ANR) under the MABCaM (ANR-16-CE04-0009), the CaPPA (ANR-10-LABX-005), the ICAR-HO2 (ANR-20-CE04-0003) contracts, and the regional ECRIN program.

References

[1] S. S. Brown, Chem. Rev. **103** (2003) 5219-5238.

[2] M. Mazurenka, A. J. Orr-Ewing, R. Peverallb and G. A. D. Ritchie, Annu. Rep. Prog. Chem. Sect. C**101** (2005) 100-142.

[3] G.R. Fowles, Introduction to Modern Optics, 2nd ed. (Rinehart and Winston, 1975), p. 328.

[4] H. Moosmuller, App. Opt. **37** (1998) 8140-8141.

[5] P. S. Johnston and K. K. Lehmann, Opt. Express **16** (2008) 15013-15023.

[6] B. Lee, K. Lehmann, J. Taylor and A. Yalin, Opt. Express **22** (2014) 11583-11591.

[7] G. Wang, A. Yalin, C. Coeur, S. Crumeyrolle, R. Akiki, E. Fertein, W. Chen, 6th International Workshop on Infrared Technologies, October 29-30, 2019, Princeton, New Jersey, USA.