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A Hybrid Plasmonic Photonic Microcavity was Designed to Improve Eye Sight Light Matter Interaction

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Editorial

Due to their improved light-matter interaction and great sensitivity, plasmatic materials have been used to display some fascinating phenomena. Surface Plasmon resonance, which is of particular interest for sensing applications and where resonance is obtained for a particular combination of angle and wavelength of the incident light, is somewhat constrained by its relatively broad resonance line and the absence of referencing to a known source of absolute resonance [1]. By utilising the link between plasmatic and molecular resonance in a hybrid SPR and acetylene device, we address these shortcomings. The coupled system gains the increased light matter interactions, angular sensitivity, and compactness of the SPR, while acetylene offers a precise and narrow resonance in the telecom band.

Because of these characteristics, our hybrid system is extremely sensitive to even the smallest changes in incident angle. Due to acetylene's high degree of dispersion, SPR is extremely sensitive to changes in refractive index. This enables the development of a feedback signal for laser stabilisation in a small volume when coupled with the acetylene transition line's narrow transition line in the telecom band. Furthermore, we have demonstrated an angular sensor with angular resolution on the order of micro radians using the high sensitivity and accuracy [2].

Due to its inherent benefits and capacity to restrict light at the nanometre scale, plasmatic devices have gained popularity in recent years. Strong nonlinear interactions, an increased spontaneous emission rate, and local interactions with single quantum emitters are just a few of the exciting phenomena that can be observed thanks to the heightened electromagnetic field that is present in close proximity to metallic surfaces [3].

For sensing applications, plasmatic phenomena are also highly appealing, particularly surface Plasmon resonance. Unfortunately, the enormous losses that cause such devices to have very broad resonances may be their only performance limitation. Furthermore, external factors have an impact on the plasmatic resonance, making such plasmatic devices less effective for applications requiring high accuracy. In contrast, the short transition linewidths and great precision of gas molecules like acetylene and carbon monoxide, as well as alkali atomic vapours like rubidium and caesium, are what distinguish them. Although temperature and pressure variations can alter molecular transition, once acetylene is sealed in a reference cell at ambient temperature, its pressure is very stable, and changes in the optical transition due to temperature-driven pressure variations are minimal. As a result, they are frequently utilised as laser stabilisation frequency standards. Applications like atomic clocks, spectrum analysers, and metrology all require laser stabilisation.

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In the recent years, we have seen a significant push toward the integration and miniaturisation of atomic vapour cells in the form of integrated Nano photonic-atomic devices, such as the ant resonant reflecting optical waveguides, the hollow core fibres, the atomic cladded wave guide, the atomic cladding mirroring resonator, and the atomic cladded Mach-Zahner interferometer [4]. Additionally, a connected plasmatic-atomic device has been introduced. While atomic vapours, such as rubidium, serve the demand for stable sources in the near-infrared frequency range, the acetylene molecule is commonly utilised as a reference source for stabilising light sources in the telecom range. Indeed, molecular spectroscopy has been demonstrated in the telecom industry using hollow core photonic crystal fibres loaded with acetylene.

Here, we demonstrate what we believe to be the first integrated coupled plasmatic-acetylene system, combining the benefits of the acetylene molecule to achieve an accurate and narrow linewidth in the telecom band with the benefits of plasmonics to achieve high sensitivity, strong field confinement, and enhanced light-matter interactions at the nanoscale. By doing this, we significantly improve the SPR system's performance while minimising the time that light interacts with matter, allowing the downsizing of our integrated device [5]. Our method of plasmatic-enhanced light-molecular interaction in a gaseous medium allows us to monitor minute changes using the stability of lasers at the telecom regime while also being able to adjust the coupled system's narrow line shape.

Conflict of Interest

None.

References

1. Lu, Yu Wei, Jing Feng Liu, Zeyang Liao and Xue Hua Wang. "Plasmonic-photonic cavity for high-efficiency single-photon blockade." *Scie Chi Phys, Mech Astro* 64 (2021): 1-10.
2. Rivera, Nicholas and Ido Kaminer. "Light–matter interactions with photonic quasiparticles." *Nat Revie Phys* 2 (2020): 538-561.
3. Yang, Longlong, Xin Xie, Jingnan Yang and Mengfei Xue, et al. "Strong light–matter interactions between gap plasmons and two-dimensional excitons under ambient conditions in a deterministic way." *Na Lett* 22 (2022): 2177-2186.
4. Lidzey, David G., D.D.C. Bradley, M.S. Skolnick and T. Virgili, et al. "Strong exciton–photon coupling in an organic semiconductor microcavity." *Nat* 395 (1998): 53-55.
5. Wen, Jinxiu, Hao Wang, Weiliang Wang and Zexiang Deng, et al. "Room-temperature strong light–matter interaction with active control in single plasmonic nanorod coupled with two-dimensional atomic crystals." *Na Lett* 17 (2017): 4689-4697.

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