

# Engineering Tamm Plasmons Resonances in Nanoporous Anodic Alumina Photonic Crystals

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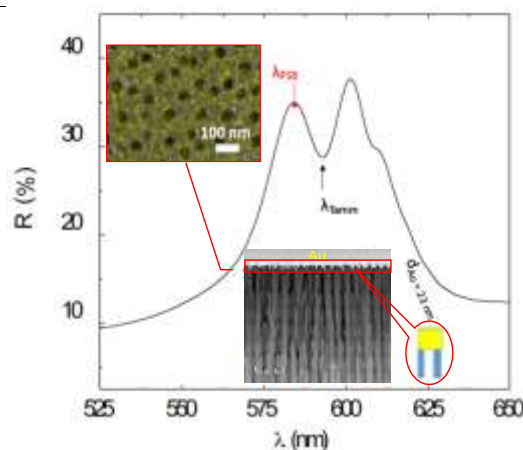
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Photonic structures based on nanoporous anodic alumina (NAA) can be fabricated using periodic anodization conditions. The optical properties of NAA structures rely intrinsically upon its nanoporous architecture, and on the geometry and distribution of its nanopores, which can be precisely engineered during the anodization process [1, 2, 3]. This work demonstrates how a sinusoidal or Gaussian pulse-like anodization approach can be used to generate nanoporous photonic crystals with highly tunable and controllable optical properties across the visible–NIR spectrum. By modifying the anodization conditions and parameters of the period function (Gaussian or sinusoidal) in the input profile, we can adjust the photonic stop bands (PSB) [4-5]. The outstanding set of properties of NAA photonic crystal (NAA-PC) demonstrate its versatility and potential for developing new photonic structures. The combination of a porous gold coating layer on top of a NAA-PCs creates a hybrid metal–dielectric structure with a narrow photonic stop band and Tamm plasmon resonances [6]. Tamm plasmon resonances are a class of surface plasmons in which incident light is confined at the interface of a hybrid structure consisting of a thin metallic coating layer and a dielectric mirror (i.e. PSB) [7]. Our analysis focuses on the design of Tamm plasmonic structures by adjusting the geometric characteristics of the plasmonic and photonic components of these hybrid optical structures. The results offer exciting new opportunities to integrate these unique photonic structures into photonic sensors and other platform materials for light-based technologies.

## References

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## Figures



**Figure 1:** Reflection spectrum of Au-coated NAA-PC reveal an apparent dip within the PSB (Tamm resonance). Insert SEM images of the top view and cross section of Au-coated NAA.