Atomic layer deposition of plasmonic transition metal nitrides

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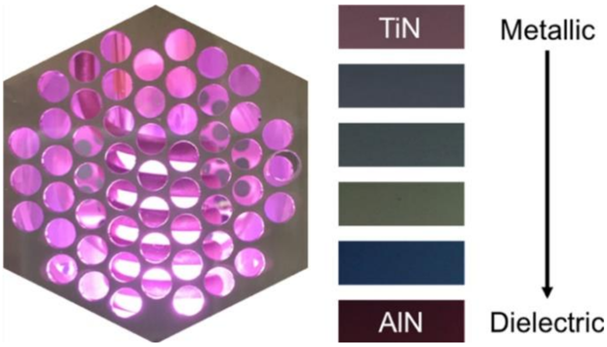
Transition metal nitrides (TMNs, especially titanium nitride, TiN) have emerged as alternative plasmonic materials to traditional coinage metals (gold, silver) thanks to their refractory nature, low cost and compatibility with the semiconductor industry processes.[1,2] Moreover, the optical response of such materials can be tuned by tailoring the synthesis process parameters from visible to infrared wavelengths, which is attractive to develop integrated plasmonic devices. As a synthetic technique, atomic layer deposition (ALD)[3] is very versatile as it allows a full control on the growing material and it can be used to obtain TMNs with high optical and plasmonic quality,[4] ternary TMNs,[5,6] or even oxynitrides[7] that exhibit intermediate properties between metals and oxides.

The subject of the student work will consist of an experimental investigation on the growth and characterization of TMNs by ALD. Different materials can be investigated depending on the specific choice, such as TMNs with high plasmonic quality (TiN, ZrN, HfN), ternary TMNs ($Ti_xAl_{1-x}N$, $Ti_xZr_{1-x}N$) or oxynitrides (TiO_xN_y) and prepared in form of thin films. The so-obtained materials will be investigated from the morphological, structural and, especially, optical point of view, the latter by transmission/reflection spectroscopy and spectroscopic ellipsometry. Depending on the targeted application, the potential of such plasmonic materials will be thoroughly investigated.



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