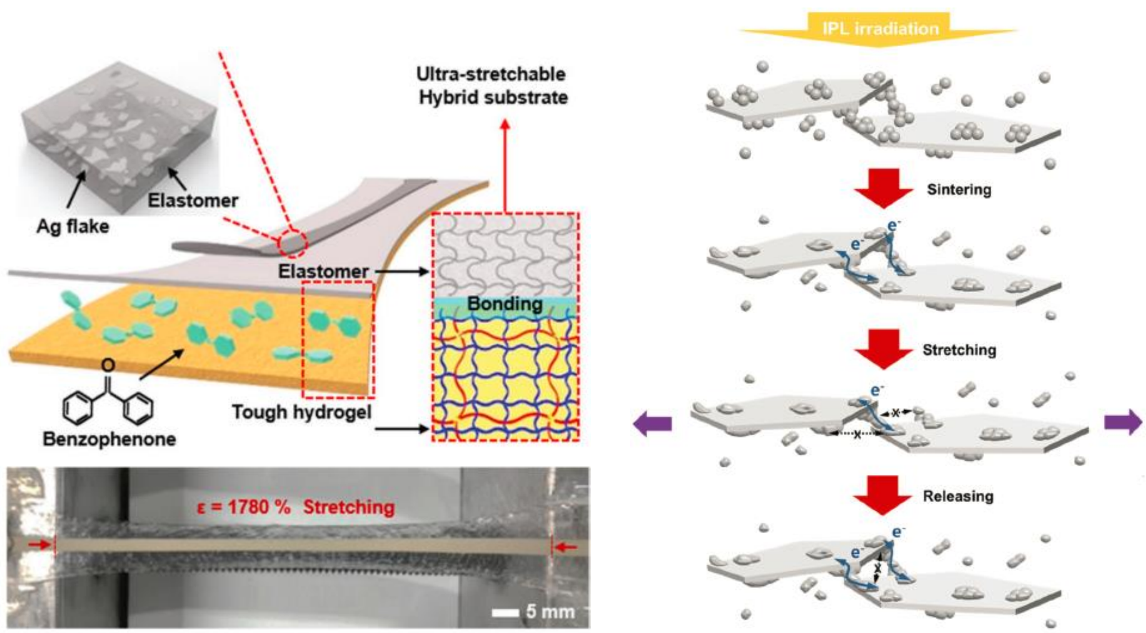
A photonic sintering derived highly transparent, stretchable sensor based on 2D conductive flakes

Deformable strain sensors have attracted considerable attention because they have met many requirements including high stretchability, sensitivity, and mechanical compliance like human skin. To improve mechanical and sensing capabilities, as well as to fabricate high-performance strain sensors various alternative approaches have been proposed. Among them, composite materials that blend conductive fillers with elastic polymers have been extensively developed owing to their excellent electrical and mechanical stabilities. In particular, flakes of various conductive materials, e.g. Ag, have received intense attention because they have a large surface contact area with the elastomer matrix, which is advantageous for maintaining an electrically conductive path under stretching. However, strain sensors based on Ag flakes generally suffer from low optical transmittance and low sensitivity owing to their high contact resistance.

Here we propose a method, to utilize transparent 2D flakes of conductive and transparent metal oxide material, e.g. ITO, embedded into stretchable polymer matrix, in combination with intense pulsed light (IPL) irradiation to create mechanical transparent sensors. For the increase of conductive percolation network density various additives in low amounts will be investigated, e.g. conductive nanowires, polymers. It will be investigated for the possibility to be used as a strain sensor, when strain is applied in lateral direction, as well as a pressure sensor, when deformation is applied perpendicularly. The effects of the IPL energy intensities on the properties of the stretchable electrode will be examined. The structural, electro-mechanical properties and durability of the stretchable composite electrode will be evaluated using various techniques, such as SEM, UV-vis-NIR, conductivity measurements, bending, stretching, and cyclic/static endurance tests.



Duration: 6 Months (Master thesis)

Required skills: Self-management, basic knowledge about chemistry, electronics and lab work experience.

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