The overall aim of the research proposal entitled *Supramolecularly engineered sensors based on 2D materials for detection of gases and pressure* (SUPRASENSE) is to develop new hybrid systems based on two-dimensional materials (2DMs) obtained *via top-down* approach and explore in depth and in a broad context both fundamental and applied aspects of the architecture *vs*. function relationship.

SUPRASESE exploits for the first time highly ordered supramolecular architectures, featuring a sub-nanometer structural precision, towards the development of highly sensitive gas and pressure sensors. The use of a modular approach in the choice of the components, including the use of molecules with well-defined lengths and rigidities, will allow the sensor to detect pressures in both the medium-pressure regime suitable for object manipulation and in the low-pressure regimes typical of gentle touch. The dynamic nature of molecules and of their supramolecular assemblies will offer high sensitivity, reversibility (cyclability) and response time to pressure changes, beyond the *state-of-the-art*. On the long term, the nanometer size of the various components will offer simple and upscalable solutions towards the integration of arrays of individual sensors (pixels) into 2D sensors.

The development of humidity and pressure sensors and in particular of electronic skin is fundamental for the realization of artificial intelligence that comes into direct contact with human bodies, and for biomedical applications such as prosthetic skin. To mimic the tactile sensing properties of natural skin, one should develop large arrays of pixels, each one acting as an independent pressure sensor supported on a flexible and stretchable substrate. The modular approach of supramolecular chemistry enables the fabrication of novel pressure sensors with enhanced performances and facile integration is real devices.