

## Fabrication of CVD graphene-based kelvin sensor for online scale monitoring system

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CVD graphene is an ideal candidate for a new class of sensor systems, which were not possible before. This is due to its 2-d nature (inert, conductive where the conductivity can be modulated when exposed to various ions, molecules, and gases). Also, Graphene is mechanically very strong yet flexible so that it can be applied on various shapes and forms; in addition to its tolerance to high temperatures (stable till 700 °C). Furthermore, the electrical characteristics of the graphene changes when chemical molecules in the surrounding covalently or non-covalently interact with the graphene. These molecules act as dopants that shift the fermi energy of the graphene. The goal of this work is to fabricate a kelvins structure like sensor with a graphene mat as an

active material between four metal pads made of Aluminum over titanium. In this study graphene sensor device based on kelvin structure is fabricated to detect NaCl salt in water solution. The successful operation of such a sensor opens a path to utilizing graphene-based devices for monitoring other scales, including  $\text{CaCO}_3$  and  $\text{BaSO}_4$  which are common for scale precipitation in the oil industry. The used graphene is grown in our lab on a copper foil, transferred to sensor structure and used as a sensing material. The electrical response of the fabricated sensor is studied by means of measuring changes in the electrical resistance before and after using the NaCl salt solution.

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