Master thesis, Semester project, Bachelor thesis

Adhesion characterization and optimization of MEMS-based strain sensors on a PDMS substrate

Keywords
MEMS, PDMS substrate, adhesion characteriza-tion, Surface Functionalization, COMSOL simulation

Motivation
To develop wearable-based strain sensors with CNT on top of Silicon-based MEMS structures, the fabricated MEMS structures need to adhere strongly to soft biocompatible substrates like PDMS. The motivation of this project is to identify a suitable strategy to develop proper adhesion be-tween the MEMS and PDMS substrate.

Goal
The MEMS structures are fabricated following proper cleanroom microfabrication procedures. In addition, the PDMS substrates need to be prepared following standard procedures using (10:1) poly-mer and crosslinker. Furthermore, the fabricated MEMS structures adhere to the PDMS substrates following physical as well as chemical procedures. The physical process will include two strategies: ei-ther bonding the MEMS using another thin layer of PDMS itself or bonding using oxygen plasma ash-ing. The chemical method of bonding the MEMS with PDMS includes using surface functionalized chemicals like APTES. The fabrication of such sub-strates is further followed by surface characteriza-tion and strain analysis for the optimization of the above-mentioned methods. Finally, the experi-ments are validated using numerical simula-tions with COMSOL Multiphysics.

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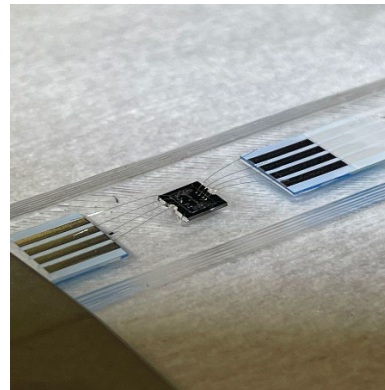Micro and Nanosystems, CLA G 1.2
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Image showing the present state of the device with the fabricated Si MEMS mounted on the PDMS substrate.

Learning Opportunities
- MEMS adhesion study on soft surfaces
- Surface adhesion characterization and analysis
- Numerical simulations with COMSOL multiphysics

Work Description
1. Sample preparation of PDMS.
2. MEMS adhesion on PDMS substrates.
3. Tensile and peel testing.
4. Surface characterization.
5. Microscopic analysis.
6. Data analysis and statistics.
7. Validation of experiments using COMSOL Multiphysics.

Your profile
- Student of Mechanical/Electrical/Biomedical /Chemical Engineering/ Chemistry.
- Interested in MEMS, characterization, and in-sights into surface characterization.
- Structured and independent working style, and innovative and creative mindset, will ex-plore new approaches.