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Design and Development of Teaching and Demo Materials about the Sputtering Facbrication Technology and Thin Film Devices

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Abstract:

This project is proposed based on the real needs of Engnieering courses such as MNE2110 “Engineering Materials”, MNE3010 “Mechanical Design”, MNE3115 “Microelectromechanical Systems”, MNE4005 “Finite Element Analysis” and MNE4110 “Sensors”: according to past teaching experiences and students feedbacks, there is a lack of a feasible hand-on practice and lab demo for the courses while student only attends the lectures for class teaching and literature reading.

Nowadays, the development of electronic devices has entered a bottleneck stage because it is difficult for electronic devices such as mobile phones and laptops to innovate based on the existing basis. Flexible electronics that substituting all currently existing hard substrate-based portable devices with wearable and flexible devices is one of the most popular research topics aiming to improve people’s lifestyles. Functional thin film (i.e. conductive films, piezoceramic films, etc.) materials have drawn wide attention owing to its high compatibility to flexible electronics and have been extensively applied in both researches and industries [1,2].

In this project, we propose to develop teaching and demo materials about the sputtering fabrication technology and flexible piezoelectric electornics. The piezoelectric principle can effectively convert mechanical energy to electrical energy and vice versa, which has great application potential and has been PI’s research focus in the past four years [3,4]. Magnetron sputtering and e-beam evaporator gain increasing importance in micro-electromechanical systems (MEMS) manufacturing to fabricate various inorganic functional thin films. Operating MEMS instruments by hand and fabricating smart thin-film devices will help our students’ learning in engineering materials, mechanics, manufacturing techniques and electronics. This will will inspire our students to make innovations and apply knowledge they learnt to the real world.

Overall, there are five learning steps desinged for undergraduate students.which start by designing an effective MEMS device for energy harvesting or sensor, devices properties simulation, functional thin films preparation via magnetron sputtering, and ends with the final evaluations and testing of the as-fabricated smart devices.