Invitation à la soutenance publique de thèse de
Monsieur Romain TUYAERTS
Master ingénieur civil physicien

Pour l’obtention du grade de Docteur en sciences de l’ingénieur et technologie

« Internal stress and opto-electronic properties of pure and Al-doped ZnO thin films deposited by reactive sputtering »

qui se déroulera
le mercredi 05 décembre 2018 à 16h15
Auditoire SUD 08
Place Croix du Sud
1348 Louvain-la-Neuve

Membres du jury :
Prof. Joris Proost (UCLouvain), supervisor
Prof. Jean-Pierre Raskin (UCLouvain), supervisor
Prof. Renaud Ronse (UCLouvain), chairperson
Prof. Thomas Pardoen (UCLouvain), secretary
Dr. Quentin Van Overmeere (PARC, USA)
Dr. Philippe Guaino (CRM, Belgium)
Dr. Marc Verdier (Grenoble INP, France)

In modern society, more and more applications use thin film coatings to improve, or add a functionality to a substrate. A widely used category of thin films is transparent conductive electrodes (TCEs) that are used in fields such as displays, touchscreens, photovoltaic solar panels, or window glasses. Different classes of materials are possible for transparent electrodes but the most popular is doped metal oxides. Indium-Tin Oxide (ITO) is currently the material with the best properties but contains a high amount of indium, a metal that is not abundant on Earth and its extraction could become problematic in only a few decades. Therefore, it is mandatory to prepare the next generation of TCEs, with cheap and abundant materials. In this thesis we focus on zinc oxide (ZnO), that is a promising material already used in some applications such as solar panels. Different dopants can be used to make conductive ZnO, and aluminum doped zinc oxide (AZO) has here been chosen because of its good properties, and because aluminum is a cheap, abundant and non-toxic metal.

The deposition technique studied in this thesis is reactive sputtering, a technique that allows to deposit thin films at room temperature on various substrates, and that is commonly used in the industry. First, the different deposition parameters are studied and their effect on the electronic and optical properties of ZnO and AZO is investigated. An in-situ analysis of the internal stress during deposition, combined with other characterizations of the optical, electrical and mechanical properties, provides new insight on the growth mechanisms and defects present in the thin films. Thanks to this analysis, the optimal deposition conditions for AZO have been identified for DC reactive sputtering. An on-chip technique was also optimized to test the mechanical properties of oxides thin films such as zinc oxide. This allowed to extract the stress-strain curve of free-standing thin films. Finally, an adapted process is also proposed for the mechanical testing of graphene, a very promising material for future TCEs.