

Ingegneria dei
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Electric systems

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Aluminium nitride films for energy harvesting

In recent years the number of sensors mounted in vehicles has strongly increased due to novel safety and energy saving constraints. Since in many applications of automotive engineering remote sensors with radio frequency transmitters are used, the limited lifetime of batteries is a crucial problem. This holds in particular for sensors mounted inside tires, which should comply with tight requirements in terms of durability and robustness. Batteries can be avoided if the sensor is able to harvest energy from the environment, typically from vibrations, by converting mechanical energy into electrical energy.

In this sense energy harvesting by means of piezoelectric materials appears to be very promising in developing battery-less power supply systems for wireless sensor networks.

Aluminium nitride films with preferred crystal orientation realized by using a magnetron sputtering system [Fig. 1] at different pressure values constitute a research activity of high potentialities. Explored operative pressures have been 0.07, 0.12, 0.3 and 0.7 Pa. Reactive Ar-N₂ mixtures (50%-50% and 0%-100%) and a DC-pulsed power supply have been used, and films have been deposited on glass substrate. Films thicknesses have been measured with surface profiler, and XRD analyses have been performed.

The aim of the research activity is the individuation of the best conditions for realization of AlN thin films in order to possible application to energy harvesting.



Fig. 1

Main research topics:

- Realization of nano-structured films by magnetron sputtering
- Thin electromagnetic shields
- Realization and characterization of thin piezoelectric materials for energy harvesting
- Modelling of electrical and electromagnetic devices
- TEM cell design for EMC/EMI tests