# Crystalline orientation influence on the ferroelectric and pyroelectric properties of PZT thin films

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Pyroelectric devices work as thermal transducers converting a thermal flux in a quantified output signal like voltage or current. In general, the largest pyroelectric coefficients were observed in the class of ferroelectric materials. Ferroelectric single crystals present the higher pyroelectric coefficients, however, preparation difficulties of single crystals in the diverse pyroelectric devices geometries stimulate the preparation of bulk ferroelectric ceramics with similar properties to those of single crystals. The use of bulk ferroelectrics in pyroelectric devices inevitably leads to cut and polishing steps to make a thin, thermally sensitive layer. Clearly, it would be desirable if the material could be deposited as a thin film permitting a higher thermal sensitivity and the direct electronic microcircuits integration. Lead zirconate - lead titanate ($(1-x)PbZrO_3$-$(x)PbTiO_3$-PZT) ferroelectric perovskite solid solutions, mainly those located either close to $PbZrO_3$ or close to the $PbTiO_3$ end of the phase diagram, showed high pyroelectric coefficient values. In this work, PZT ($PbZr_{0.20}Ti_{0.80}O_3$) thin films obtained through oxide precursors chemical method were prepared on silicon/platinum substrates with different crystalline orientation. The thin films crystalline orientation direction and the degree of orientation for the different substrates were analyzed. The orientation influences on the ferroelectric and pyroelectric thin films properties were investigated. X-ray diffraction results showed a strong substrate influence in the thin films orientation. The remanent polarization ($P_r$) for the (111) oriented thin film exhibits the highest value. Pyroelectric characterization, performed using a dynamic method, that consists in current or voltage measurements as result of small temperature changes caused from a controlled pulsed laser radiation, also evidenced high pyroelectric voltage/current responsivity values for (111) oriented thin films.