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Títol de la tesi	Interdigitated back-contacted (IBC) c-Si solar cells based on laser processed dielectric layers
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The goal of this thesis is the fabrication of high-efficiency interdigitated back-contact (IBC) c-Si solar cell at low temperature and low-cost manufacturing technology. This thesis proposes a new concept and at the same time a simple and elegant fabrication process that has been fully developed and culminated with the fabrication of a "cold" IBC solar cell as a proof-of-concept.
To carry out this proposal, we focus our research on the study and application of low-temperature processes such as Atomic Layer Deposition (ALD) and Plasma-enhanced Chemical Vapor Deposition (PECVD) to deposit dielectric layers. A process based on laser techniques was also developed to be applied on these dielectric layers to form p+ and n+ regions into the c-Silicon sample. The laser highly-doped regions are formed in a point-like structure avoiding the classical high-temperature diffusion process. The dielectrics used, Al2O3 and a-SiCx (n) stack , play the role of aluminum and phosphorous dopant sources respectively. A detailed study has been accomplished to find the best laser parameters and obtain the optimal p++ and n++ junction. At the same time, these layers work as excellent surface passivating films and improves the front and the rear reflectance. To get the film which better fulfills these tasks, an extensive investigation has been performed to optimize the deposition and post-deposition processes in terms of temperature, time and layer thickness.

In order to fabricate the "cold" IBC cell, we firstly developed a IBC cell performed on p-type FZ c-Si with a conventional phosphorous diffusion. The SiCx(n) stack passivated the n region interface as well as provided phosphorous atoms to create n++ regions or selective emitter structures after laser processing. The aluminium atoms supplied by the Al2O3 layer formed a p++ region or Back-surface field (BSF) after the laser processing and simultaneously passivated the p region interface. A promising efficiency of 18.7% (Jsc= 39.1 mA/cm2, Voc= 638 mV, FF= 75.3%) was obtained as a result of this new concept. The first "cold" IBC cell was obtained after elimination of conventional phosphorous diffusion and rearrangement of the fabrication steps in order to reduce the thermal budget and the complex photolithographic steps. The laser employed is a pulsed Nd-YAG lamp-pumped working at 1064 nm in nanosecond regime. The efficiency achieved was 18.0% (Jsc = 39.2 mA/cm2, Voc= 647mV, FF= 71.1%) on 280 micras thick 2.5 Ohmcm n-type FZ Si with a designated area of 9 cm2. The final efficciency achieved of the final "Cold" IBC cell was 20% (Jsc= 40.5 mA/cm2, Voc = 650 mV and FF = 76.4%)) using a pulsed Nd:YVO4 Laser operating at 355 nm (UV). The total fabrication process was carried out at low temperatures (below 400 ºC) avoiding the high-temperature difussion processes.

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