Rafael Cardoso Toledo, Chen Ying An, Irajá Newton Bandeira
Instituto Nacional de Pesquisas Espaciais - INPE
Composition profiles of the eutectic alloy Bi43Sn57 atomic % grown by normal and inverted vertical Bridgman methods are presented and the study of the solute alloy redistribution is made. The inverted vertical Bridgman method (IVB), where the solidification occurs from the top to the bottom of the melt under a destabilizing thermal gradient, allows the growth of crystals with buoyancy-driven convection different from that of the usual vertical Bridgman (VB) configuration. The scope of this work is to study the influence of the gravity in the convection process. The convection is smaller in samples solidified by VB, with more stable solute and density distribution profiles. In both methods the samples presented dendritic structures plus irregular eutectic structure along its length.

24. Lead halide perovskite synthesized from sputtered lead sulphide
Francisco das Chagas Marques, Jose Maria Clemente da Silva Filho, Viktor A. Ermakov
Universidade Estadual de Campinas
In the last few years, research on dye-sensitised devices has been focused on the development of solar cells, based on CH3NH3PbX3 (X = I, Br, Cl) composites with perovskite structure. The deposition of perovskite thin films is usually carried out by solution-based processes using spin-coating techniques that result in the production of high quality films. Solar cells made by this method exceed 20 % efficiency, with the potential for use in large scale production through ink print or screen printing techniques. As an alternative route, perovskite thin films can be deposited through thermal evaporation. Here we propose a new method for the production of CH3NH3PbI3, based on a radio-frequency (rf) -sputtering technique that results in a high reproducibility of the films and is compatible with roll-to-roll processes. We deposited a thin film of lead-sulphide (PbS) and converted it into perovskite by placing the film in an iodine atmosphere, followed by dipping in a solution of methylammonium iodide (CH3NH3I). The conversions to PbI2 and CH3NH3I were confirmed by elemental analyses, absorption, and photoluminescence spectroscopy. Structural properties were revealed by X-ray diffraction and infrared and Raman spectroscopy.

25. Formation of structural defects during Bi_2Te_3 epitaxy investigated by a Monte Carlo computational model
Celso Israel Fornari, Gabriel Fornari, Paulo H. de O. Rappl, Eduardo Abramof, Jerônimo dos S. Travelho
Instituto Nacional de Pesquisas Espaciais
Bismuth telluride, in Bi_2Te_3 phase, is an archetype of three-dimensional topological insulator. This material presents topological surface states (TSS), shaped like a Dirac cone, crossing the material band gap [1]. These TSS present linear dispersion, resulting in massless Dirac fermions in the surface with extremely high Fermi velocities and bulk insulator behavior. The massless Dirac fermions possess spin-locked to the momentum and are protected from backscattering due to time reversal symmetry, which open-up several possibilities of applications in spintronics and quantum computing [2]. However,

presence of structural defects in this compound changes the chemical potential, resulting in bulk conduction which overwhelms the metallic surface states, hampering these topological states from electrical measurements. By controlling the chemical potential of the sample is possible to tune from p to n, passing through a bulk insulator phase. A truly topological insulator compound must have the Fermi level located inside the material band gap, i.e., crossing only the TSS [3]. In this work, we applied a Monte Carlo epitaxial growth model to study the case of bismuth telluride. By changing the growth conditions in the model, we monitored the formation of structural defects. The computational model was validated to a set of experimental data. The simulation results were able to explain a p-to-n transition that occurs by increasing the substrate temperature in which the epitaxial films are grown. References: [1] Y.L. Chen et al., Science 325, 178 (2009); [2] Y. Ando, J. Phys. Soc. Japan. 82, 102001 (2013); [3] K. Hoefer et al., PNAS 111, 14979 (2014).

26. Growth and characterization of Mn-doped ZnO thin films
Camila Ianhez Pereira dos Santos, Marcio Peron Franco de Godoy
Universidade Federal de São Carlos
Zinc Oxide (ZnO) is a very interesting material due to its wide bandgap (3.37eV) suitable to transparent optoelectronic devices. Manganese (Mn) incorporation in wide bandgap semiconductors is a current topic due to new magnetic and optical properties. Many methods can be applied to obtain Mn-doped ZnO. This work shows an investigation of ZnO thin films doped with Mn at different concentrations (up to 10%) as well two reference-samples: Mn3O4 and ZnO. The samples were grown by Spray Pyrolysis on top of glass substrates using as precursors zinc acetate dihydrate and manganese acetate tetrahydrate in aqueous solution with 10-2 molarity. The system was characterized by X-ray Diffraction (XRD), Scanning Electron Microscopy (SEM), and Optical Transmittance and Absorbance. ZnO and Mn3O4 were identified by XRD as wurtzite phase (grown preferentially along the (002) direction) and hausmannite phase (grown preferentially along the (121) direction), respectively. The crystallite size in the sample of ZnO was approximately 13 nm. This size decreased a quarter from 3% Mn-doping with no evidence of secondary Mn-related phases. There was no significant change in the optical gap value up to 7% Mn. Half of the samples was subjected to an annealing at 500°C during one hour. XRD analysis indicated a phase transition from Mn3O4 to alpha-Mn2O3 in the bixbiite phase without a preferential growth direction, and a crystallite size around 25 nm. The images obtained by SEM for as-grown and annealed samples showed Mn segregation after thermal treatment. The bandgap decreased above 1% Mn inserted in the lattice, which corroborates the Mn-segregation for the annealed samples. Our results indicate that the Spray Pyrolysis method is a convenient route to obtain well diluted ZnMnO thin films.

27. Strained Graphene in the quantum Hall regime
Daiara Faria, Carlos León, Ramon Carrillo-Bastos, Andrea Latgé, Nancy Sandler
Universidade do Estado do Rio de Janeiro, Universidade Federal Fluminense, Universidad Autónoma de Baja California, Ohio University
The coupling between electronic and mechanical properties in bidimensional materials has become an useful tool to control their properties. Graphene zigzag nanoribbons with