

## Change in stacking order and broken time reversal symmetry in bi-layer Graphene

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The AB-stacking for the bi-layer graphene (BLG) system, which is the elementary building block of 3D graphite with the A-carbon of the upper sheet lying on top of the B-carbon of the lower one, corresponds to a certain number of hopping parameters that also occur in the slightly shifted AA-stacked system where the A atoms of the two layers are over each other and the B atoms of the layers are displaced with respect to each other. Notwithstanding the fact that both the stacking orders involve the orbital overlaps between the C atoms, the important outcome the unbroken (broken) time reversal symmetry in AB-(AA-) stacking implies intrinsically different single-particle excitation spectrum in the two cases. Consequently, in the AA-stacked system one may observe certain phenomena, such as the quantum anomalous Hall state being the prime instability, and so on, which have eluded experimental detection so far in the the AB-stacked system. We find that (i) the activation energy necessary to destroy this AA-stacked phase is large enough to make it feasible at room temperature, and (ii) there is significant increase in the dynamical conductivity in this phase.

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## Influence of geometry and dimensions of flow fields in a proton exchange membrane fuel cell

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The optimization of the reactants distribution plate in fuel cells to uniformly distribute the reactants should increase its performance. They are also important to remove heat from the active areas, act as a current collector and prevent the flood of reactants. These results can be obtained through an appropriate flow field design of distribution reactant plate. Studies showed that parallel serpentine flow field design and discontinuous flow fields design have better results. Based on these studies the objective of this research was to develop and characterize a new flow field design which combined characteristics of parallel serpentine flow field and discontinuous flow field design. Two different types of plates discontinued parallel serpentine flow fields (DPSFF) were tested in a direct ethanol fuel cell (DEFC) in different situations and operational conditions. The analyses of the experimental results it was concluded that a DEFC, when equipped with a DPSFF in the cathode and reactant distribution plate of flow channels arranged in serpentine flow fields (SFF) at the anode, has a better performance due to the generation of higher oxygen pressure compared to ethanol at the anode. Increased oxygen pressure due to discontinuous flow of DPSFF reduced the potential drop in the diffusion of limiting performance electrode (cathode) in addition, it generated a pressure barrier against the ethanol and the water flow arriving from the anode due to membrane permeability.

### Biography

Stephen Carpenter obtained an M.Phil Eng at The University of Birmingham and his PhD at Manchester Metropolitan University UK. He now lectures material science at FURB Santa Catarina Brazil. His research interests are in the area of surface engineering and material science in general.

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