Formation and electronic properties of InSb nanocrosses

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Signatures of Majorana fermions have recently been reported in InSb single - nanowire devices.[1,2] In order to prove the non-abelian properties of Majorana fermions, it is necessary to perform logical operations by interchanging the positions of the two Majoranas.[3] This is not possible in a single InSb nanowire; a Majorana fermion is its own antiparticle so when two Majoranas meet they annihilate. Therefore, more complex structures are needed, like T-shape wires.

Here, we investigate the formation of X- and T- shaped InSb nanowires. Depending on the meeting angle of the two wires, these structures can be single crystalline. We are now developing a method to increase the yield of single-crystalline crosses based on growth on (001) InP substrate. By using the substrate orientation a high control of the crossing mechanism is achieved: all of the crossed nanowires meet under an angle of 70.5°, which corresponds to the angle between two <111> directions in a monocrystal. With this method we can also make nanowire networks. First electrical measurements done on these nanostructures will be discussed. Hall effect measurements at low temperature prove the high quality of these new structures.

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