Defect-Induced Defect-mediated magnetism in Diluted Magnetic Semiconductors

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While it has been established that dopants (structural defects and/or impurities) can create unpaired electrons in otherwise non-magnetic materials, their ferromagnetic coupling (essential for developing feromagnetism) requires additional mechanisms. In the present work it is shown that the dopant induced unpaired electrons may be coupled ferromagnetically upon the synergetic action of two suitably chosen *codopants*. The essence of the *codoping* is that one of the *codopants* induces or provides the unpaired electrons, while the other codopant mediates their ferromagnetic coupling even for defect/impurity concentrations smaller than those dictated by the percolation threshold. These findings allow us to propose a more general recipe for developing this type of defect-induced defect-mediated (DIDM) ferromagnetism in new materials of great technological interest. The recipe is quite general, although its realization is system specific. In each case, the required basic step is to find two *complementary and synergetic codopants* which are able to act as a donor-acceptor pair. DIDM magnetism appears to be applicable for a wide variety of materials, and can be especially very effective in diluted magnetic semiconductors materials.