nanocrystals obtained from sulfate, while for chloride solutions the effect is more significant - from 54.5% to 72.6%.

As can be seen from obtained results, the use of chloride and sulphate electrolyte leads to the formation of CdTe nanocrystals with a hexagonal structure.

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TUNABLE DIMER SYSTEMS OF COBALT ATOMS ON PHOSPHORENE

Badrtdinov D.I.[1*], Sotnikov O.M.[1], Rudenko A.N.[3, 2,1], Katsnelson M.I.[2,1], Mazurenko V.V.[1]

[1)] Ural Federal University, Yekaterinburg, Russia
[2)] Radboud University, Nijmegen, The Netherlands
[3)] Wuhan University, Wuhan, China
*E-mail: reason2205@yandex.ru

In this work we report on a comprehensive study of a dimer system, two cobalt atoms on phosphorene surface. Since each cobalt atom can be stabilized in high- and low-spin states, the couplings in this dimer system can be tuned. More specifically, it was shown that applying a small bias voltage one can change interaction between two atoms within dimer from ferromagnetic to antiferromagnetic and vice versa.

The structures containing few magnetic atoms on nonmagnetic surface is considered to be the prospective system, giving the possibility to realise the data storage and spintronic devices [1]. Recently, experimentally by using scanning tunnelling microscopy (STM) technique it was revealed that cobalt atom on black phosphorus demonstrates two novel — high (H) and low (L) spin states [2]. Low spin state has magnetisation 1 μ_B, whereas high spin state can be magnetised until ~ 2.5 μ_B. Within STM techniques it is possible to change spin states of the corresponding cobalt atom from low to high spin states and vice versa applying a small bias voltage between tip and surface. As for considering cluster of atoms, the realisation of tunable spin states gives the unique opportunity to study interacting atoms in combination of different spin states: high-high (HH), high-low (HL) and low-low (LL).

The magnetic model of two interacting cobalt atoms on one layer of black phosphorus (phosphorene) was constructed within density functional theory by using local density approximation (LDA). Correlations were taken on the level of DFT+U, where Coulomb repulsion parameter makes the similar influence as a bias voltage in

experiment. The constructed model contains the isotropic exchange interaction between cobalt atoms, on-site anisotropy term and intersite Dzyaloshinskii-Moriya interactions originated from spin-orbit coupling. The obtained parameters of isotropic exchange interactions between two cobalt atoms in different stable positions demonstrate the RKKY-type oscillations, where the period of the oscillations depends on the the direction of the dimer alignment (armchair or zigzag), and the spin states of the corresponding cobalt atoms (Fig. 1).

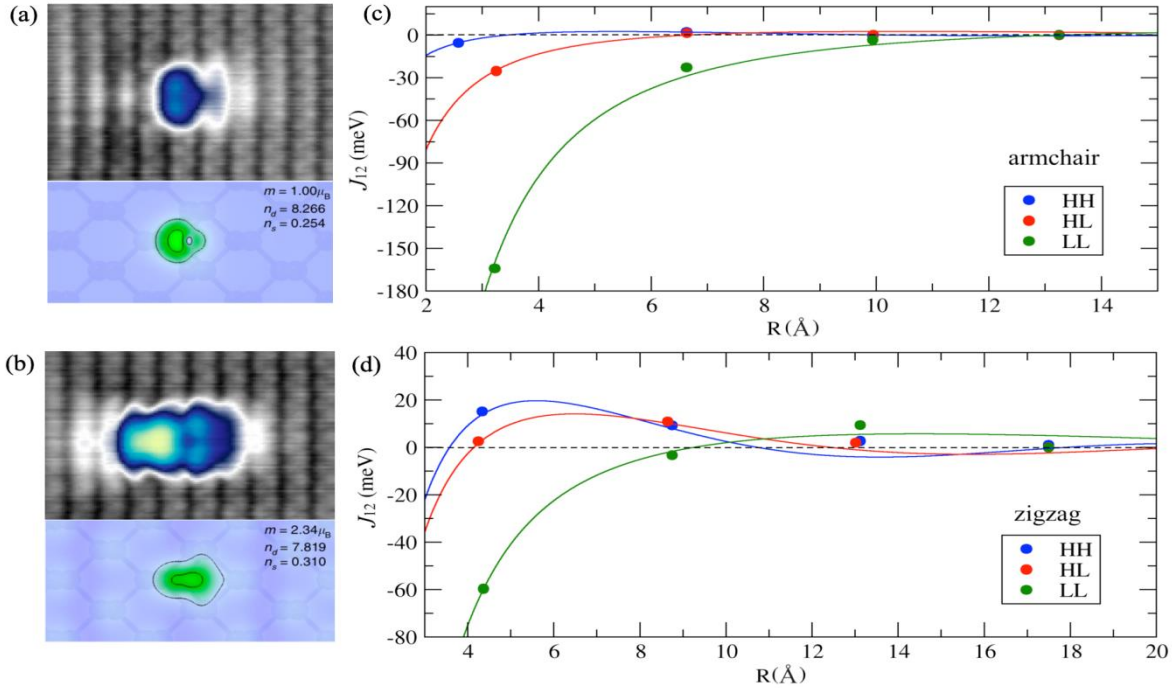

Fig. 1. High resolution STM image and DFT charge density distributions for cobalt atom on phosphorene in low (a) and high (b) spin states. Figures are taken from Ref. [2]. (c) - (d) Resulting isotropic exchange interactions between cobalt atom along armchair and zigzag directions in different spin states: HH, HL and LL.

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