2D Van der Waals Lateral Spin Valve

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Abstract
A 2D Van der Waals spin valve in monolayer blue phosphorus sandwiched between two half-metallic ferromagnetic (FM) CrN monolayers is proposed based on the density functional theory calculations together with Boltzmann transport theory. We studied the electronic, structural and spin-dependent transport properties of monolayer CrN, P/CrN and CrN/P/CrN systems. Among the different possible stacking patterns between monolayer blue phosphorus and monolayer CrN, AA stacking is only one to be dynamically stable.
Moreover, we calculated the exchange interactions and single-ion anisotropy parameters to estimate the Curie temperature within the random phase approximation, which is found to be to be well above the room temperature for CrN/P/CrN which is promising feature for a spin-valve device. The alteration of magnetic ordering (FM and AFM) modifies electronic transport causing magnetoresistance of up to 12% in the low-doping regime. [1]

REFERENCES

[1] M. Modarresi, A. Mogulkoc, Y. Mogulkoc and A.N. Rudenko, Physical Review Applied, 11 (2019) 064015.

FIGURES

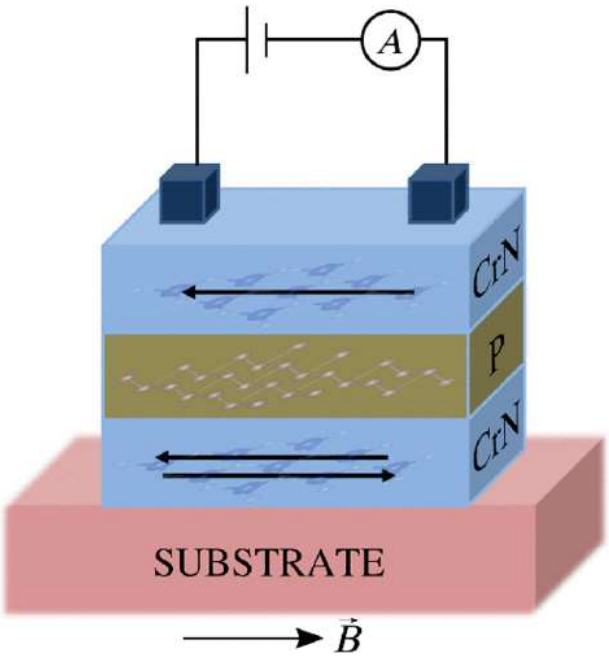

Figure 1: A lateral spin-valve device based on CrN/P/CrN. [1]