Compressive soliton wave in phosphorene inducing by high-loading impact

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Compressive solitons appear in crystals as a result of a shock loading, and they present effective energy transport over long distances with low attenuation of energy. The propagation of compressive soliton wave in two-dimensional materials has been studied much less than in three-dimensional crystals. Here, the molecular dynamics method is used to analyze the dynamics of compressive solitons in monolayer black phosphorus (phosphorene). The mechanisms of energy dissipation by the network are analyzed. The results obtained for phospohrene has been compared with the results obtained earlier for graphene and boron nitride. The damping of compressive solitons in phosphorene is stronger than in graphene and boron nitride, because it has a puckered structure and, consequently, more energy dissipation channels. In general, our results help to understand the nonlinear dynamics of localized excitations in phosphorene. Authors thank for the financial support the Council of the President of the Russian Federation for State Support of Young Russian Scientists (grant No. MK-891.2022.1.2).