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Title: Electronic properties of rippled graphene

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Small ranges of ripples in graphene have been modeled. The electronic properties of rippled graphene have been investigated using first-principles calculations. Compared with flat graphene, there is a band gap opening in rippled graphene. Generally, the value of energy gaps increases as the height of ripples increase, but it decreases as the range of ripples enlarges. The maximum value of energy gaps in rippled graphene can reach several hundred meV, which turns rippled graphene into good semiconductor. As a result, the magnitude of energy gaps can be tuned effectively by controlling the range and height of ripples in graphene.