Terrestrial magma ocean origin of the Moon: A numerical study of a giant impact incorporating the difference of the equations of state for liquids and solids

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The origin of the Moon is one of the most important topics in the planetary science and geophysics.
Since the giant impact (GI) scenario was suggested, it has been believed that the Moon was formed by the impact of relatively large object (Mars-size) to a growing Earth.
Recently, however, the GI has been challenged; the isotope ratios of particular elements show nearly identical values for the bulk component of the Earth and that of the Moon.
This means that the Moon should have been formed from the proto-Earth originated materials.
However, previous numerical simulations of the GI concluded that the Moon was formed from the impactor.
In order to resolve this problem, several modified models to the GI have been suggested.
However, most of them have difficulties to explain much higher angular momentum and the dissimilarity of the FeO content.
Recently, a new model, to form the Moon from the Earth’s magma ocean, is suggested.
According to this scenario, the majority of heating occurs in the terrestrial magma ocean, which results in the ejection of the target-originated materials.
Since the formation of the FeO-rich magma ocean is a natural consequence of the formation of the proto-Earth, this scenario can also explain the dissimilarity of the FeO content.
We carried out the numerical simulations of GI in which the magma ocean is modeled with an equation of state for liquid.
We show the comparisons of the GI between liquid equation state and solid one.

