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Controlling the percolation behavior of conductor-insulator composites by changing the granular size of insulators[1] KAZUHITO SHIDA, RYOJI SAHARA, HIROSHI MIZUSEKI, YOSHIYUKI KAWAZOE — The critical behavior of percolation model does not depend on the detail of the embedding lattice. This fact can be a hard obstacle when one attempt to modulate and control the characteristics of the composite materials because the limit of modulation is limited by the percolation threshold, as in the case of substitution of expensive conductor materials by inexpensive insulator materials. Many attempts to solve this problem by changing the sizes and aspect ratios of conductor particles, expecting their effect in enhancing conduction as a "bridge" is not working well. We report our attempt to realize the same goal by introducing size differences in the insulator particles, not conductor particles. The effective transition point observed is actually lowered to 0.52 by this modulation from about 0.59 of conventional site percolation model (2D). The statistical nature of this novel model, in particular the optimum design of insulator particle size distribution, is a completely new and interesting theoretical problem. Moreover, this is considered to be a promising technique to reduce the amount of expensive conductor, for example the Indium in typical transparent conductor film.

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