Percolation threshold of curved linear objects for network of metal nanowires

이준모, 남재욱†
서울대학교
(jaewooknam@snu.ac.kr†)

Due to the limitations of metal oxide-based transparent conductive films (TCFs), several materials have been studied as alternatives of TCF for next-generation electronics. Especially, the networks of high-aspect-ratio metal nanowires, such as silver and copper nanowires, are promising, because of the remarkable optoelectrical performances. High-aspect-ratio metal nanowires tend to be curved after various coating processes. However, plenty of studies investigated the optoelectrical performances of the network representing the nanowires as straight linear objects, i.e., sticks, without considering the curviness.

In this study, the percolation threshold of curved linear objects is studied, describing them as quadratic Bézier curves, to reflect the curviness. We consider curviness angles, defined to quantify the degree of curviness, from 10° to 80° in intervals of 10°. Using Monte Carlo simulations, the critical number densities of the curves are calculated. Then, the relation between the curviness angle and the critical number density is found via excluded area. Moreover, we find that the conductivity exponent of the network is the same as the network of sticks.