# Large-scale non-destructive assembly of the hybrid conductive nanomesh of single-walled carbon nanotube with biological glue

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Assembly of two-dimensional nanomaterials in large-scale is of great importance in both scientific and technological aspects. Here we report a broadly applicable scheme to assemble a large-area and free-standing hybrid electronic nanomembrane. We utilized biomolecular recognition of genetically engineered M13 phage toward single-walled carbon nanotubes (SWNTs) combined with a dialysis method. SWNTs are non-destructively assembled by M13 phage to form a free-standing conductive nanomesh in solution. A conductive nanomesh can be simply transferred onto various substrates. We will discuss two different applications employing the conductive nanomesh on their platforms; 1) For tactile sensing, a flexible substrate with conductive nanomeshes served as the active tactile sensing layer showing high sensitivity at low-pressure (< 1 kPa). 2) For biosensing, the nanomesh which was further non-destructively assembled with enzymes enables highly facilitated biomolecular electron transfer with unprecedented versatility and applicability. We believe hydro-dynamically assembled conductive nanomesh could serve as a large-scale nanostructured electrical platform for flexible wearable electronics applications.