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(71) Applicant: **WILLIAM MARSH RICE UNIVERSITY**
[US/US]; 6100 Main Street, Houston, TX 77005 (US).

(72) Inventors: **TOUR, James, M.**; 4625 Spruce Street, Bel-
laire, TX 77401 (US). **ZHU, Yu**; 9726 Bevllyn Dr., Hous-
ton, TX 77025 (US). **LI, Lei**; c/o Rice University, Smalley
Institute For Nanoscale Science And, Technology, Ms-60,
6100 Main Street, Houston, TX 77005 (US). **YAN, Zheng**;

1240 Richmond Ave, Richmond Square 2040, Houston,
TX 77006 (US). **LIN, Jian**; 5750 Gulfon Street, Houston,
TX 77081 (US).

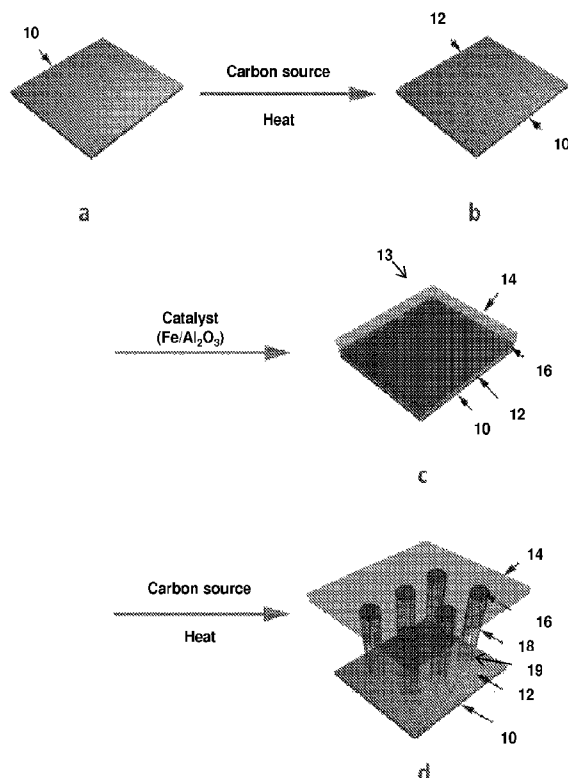
(74) Agent: **AMINI, Farhang**; Winstead PC, P.O. Box
131851, Dallas, TX 75313 (US).

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(54) Title: GRAPHENE-CARBON NANOTUBE HYBRID MATERIALS AND USE AS ELECTRODES



(57) Abstract: In some embodiments, the present invention provides methods of making graphene- carbon nanotube hybrid materials. In some embodiments, such methods generally include: (1) associating a graphene film with a sub-
strate; (2) applying a catalyst and a carbon source to the
graphene film; and (3) growing carbon nanotubes on the
graphene film. In some embodiments, the grown carbon
nanotubes become covalently linked to the graphene film
through carbon-carbon bonds that are located at one or more
junctions between the carbon nanotubes and the graphene
film. In some embodiments, the grown carbon nanotubes are
in ohmic contact with the graphene film through the carbon-
carbon bonds at the one or more junctions. In some embodi-
ments, the one or more junctions may include seven-
membered carbon rings. Additional embodiments of the
present invention pertain to graphene-carbon nanotube hy-
brid materials that are formed in accordance with the meth-
ods of the present invention.



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