

## ABSTRACT

### SOLVENT-BASED METHODS FOR PRODUCTION OF GRAPHENE NANORIBBONS

The present invention provides methods of preparing functionalized graphene nanoribbons. Such methods include: (1) exposing a plurality of carbon nanotubes (CNTs) to an alkali metal source in the presence of an aprotic solvent to open them; and (2) exposing the opened CNTs to an electrophile to form functionalized graphene nanoribbons (GNRs). The methods may also include a step of exposing the opened CNTs to a protic solvent to quench any reactive species on them. Additional methods include preparing unfunctionalized GNRs by: (1) exposing a plurality of CNTs to an alkali metal source in the presence of an aprotic solvent to open them; and (2) exposing the opened CNTs to a protic solvent to form unfunctionalized GNRs.

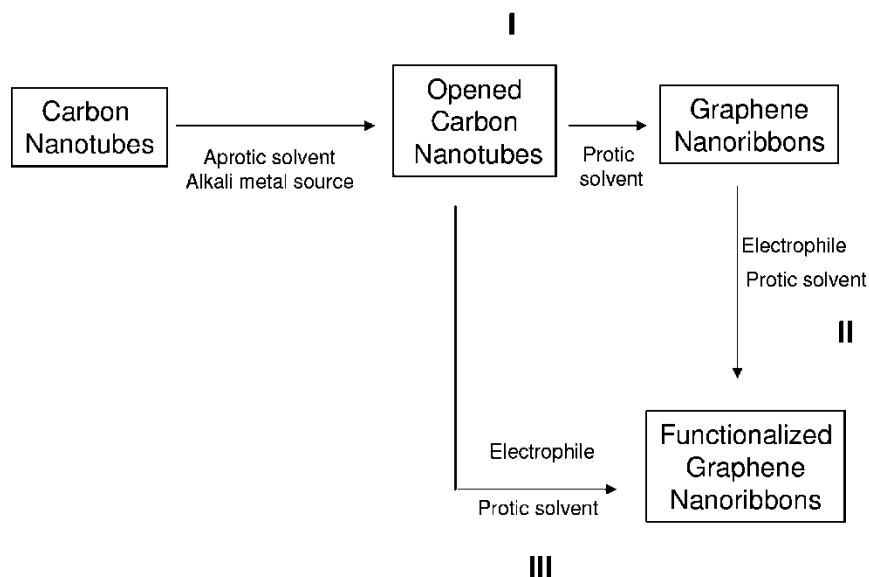


FIG. 1

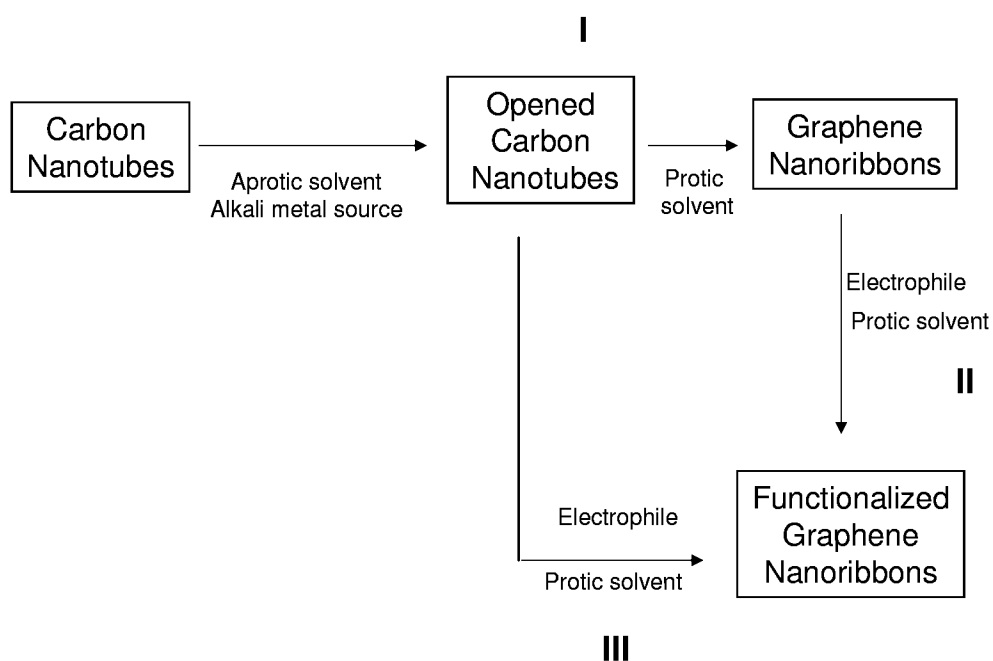


FIG. 1

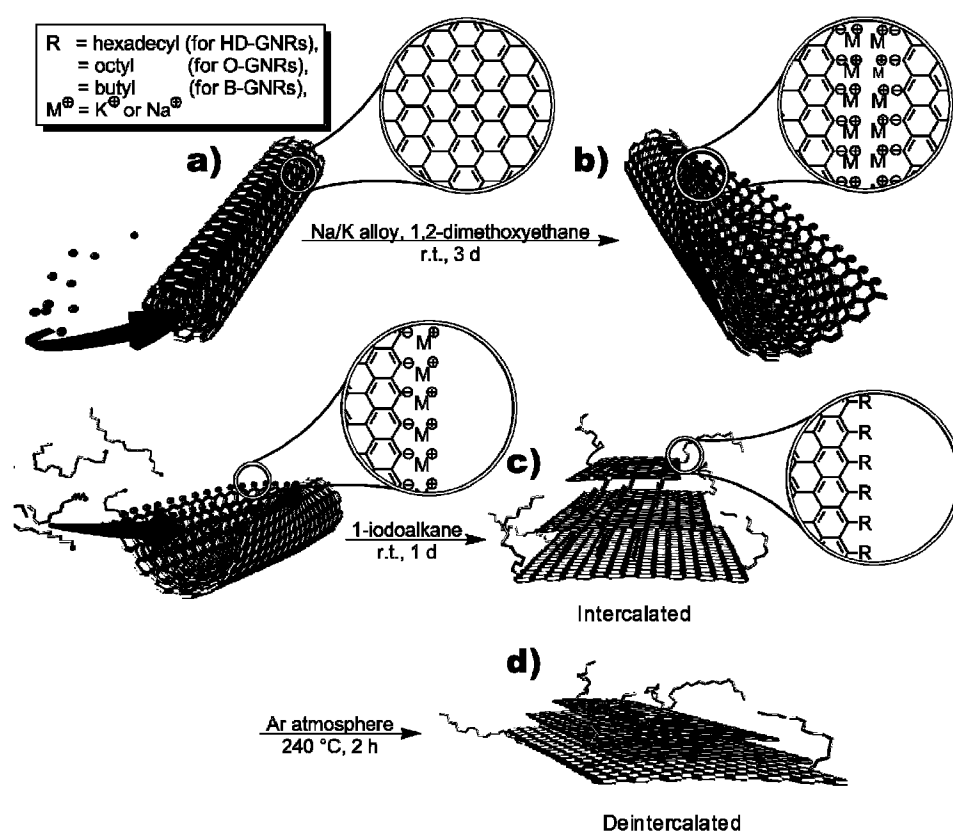
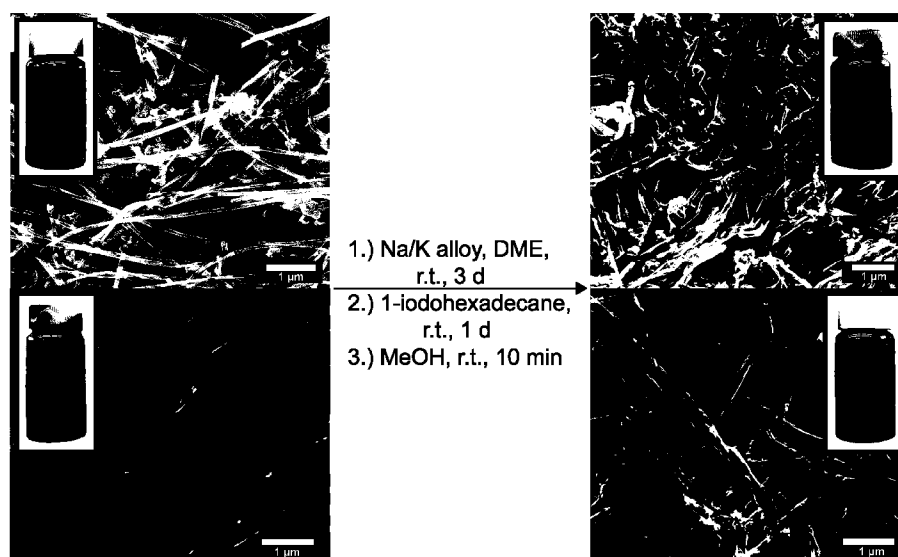
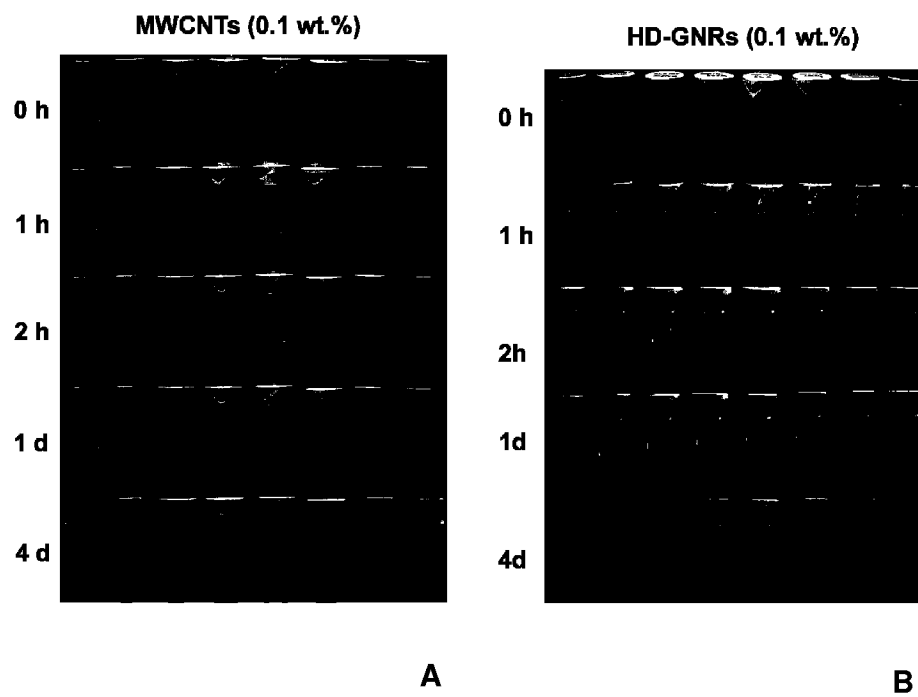
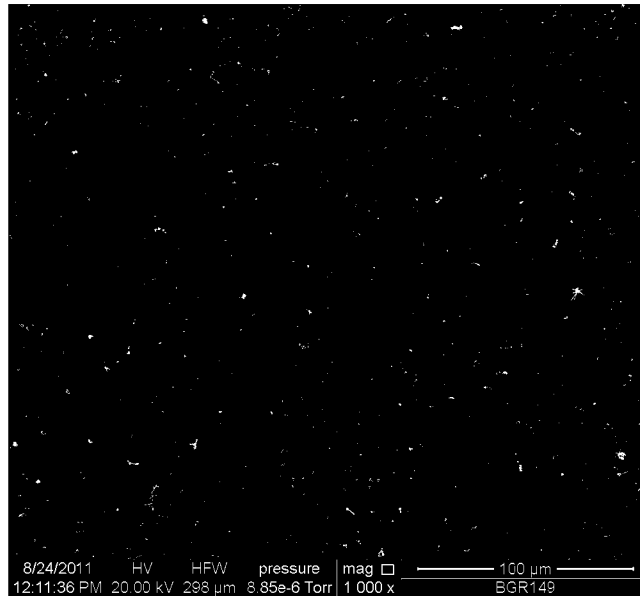


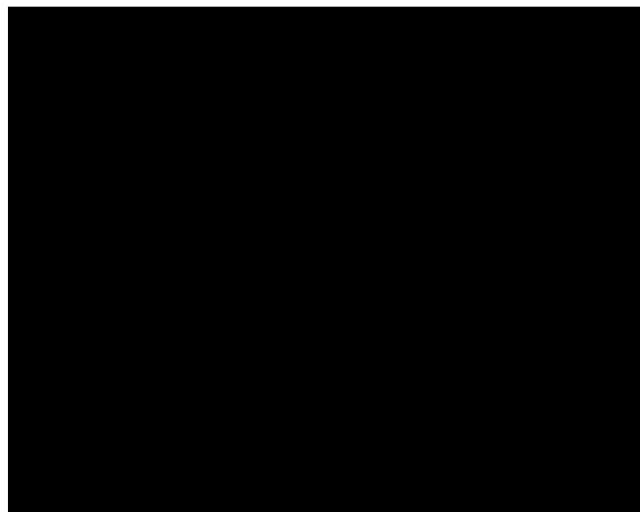
FIG. 2

**FIG. 3**

**FIG. 4**



**A**



**B**

**FIG. 5**

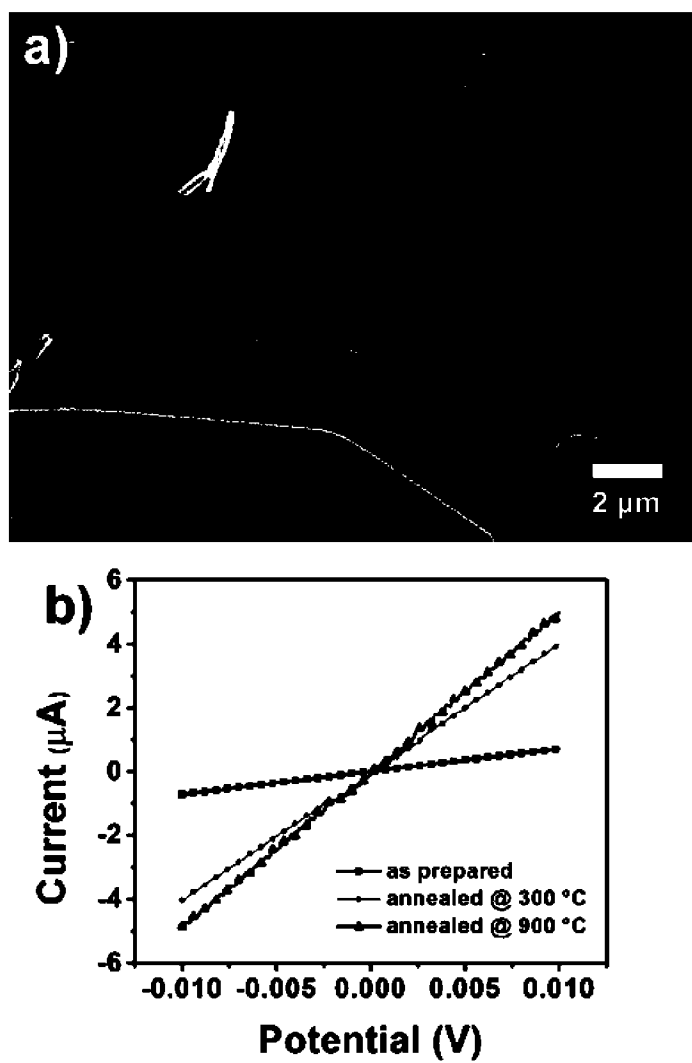
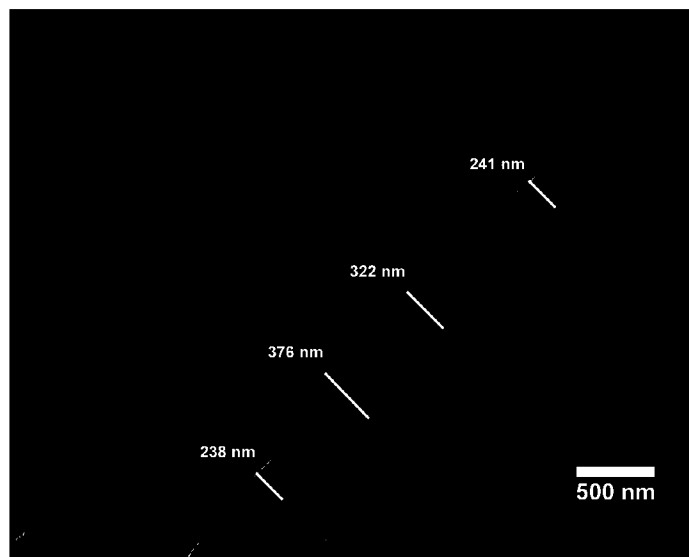
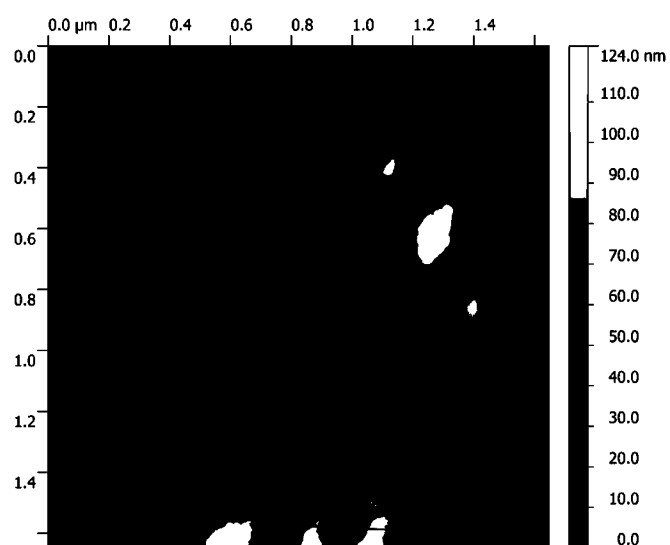
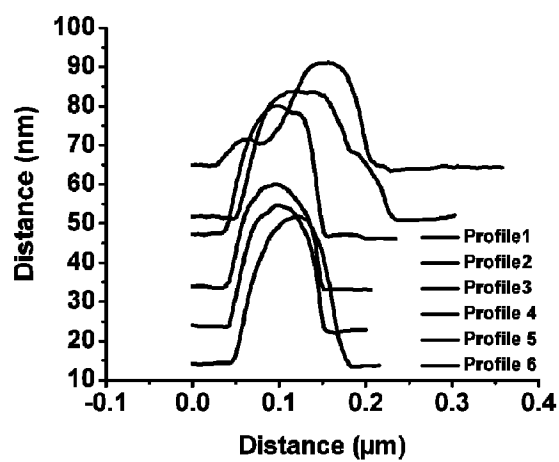


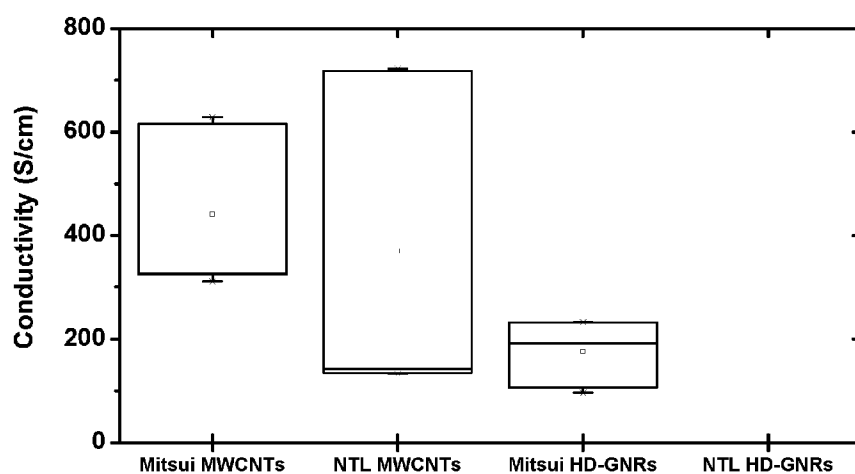
FIG. 6



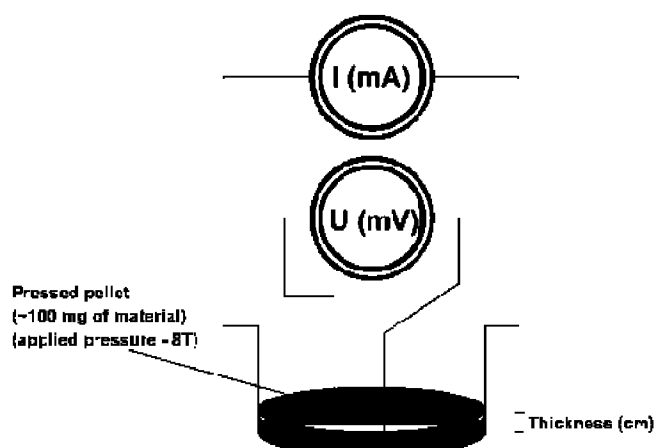
**FIG. 7**



**A****B****FIG. 8**



A



B

FIG. 9

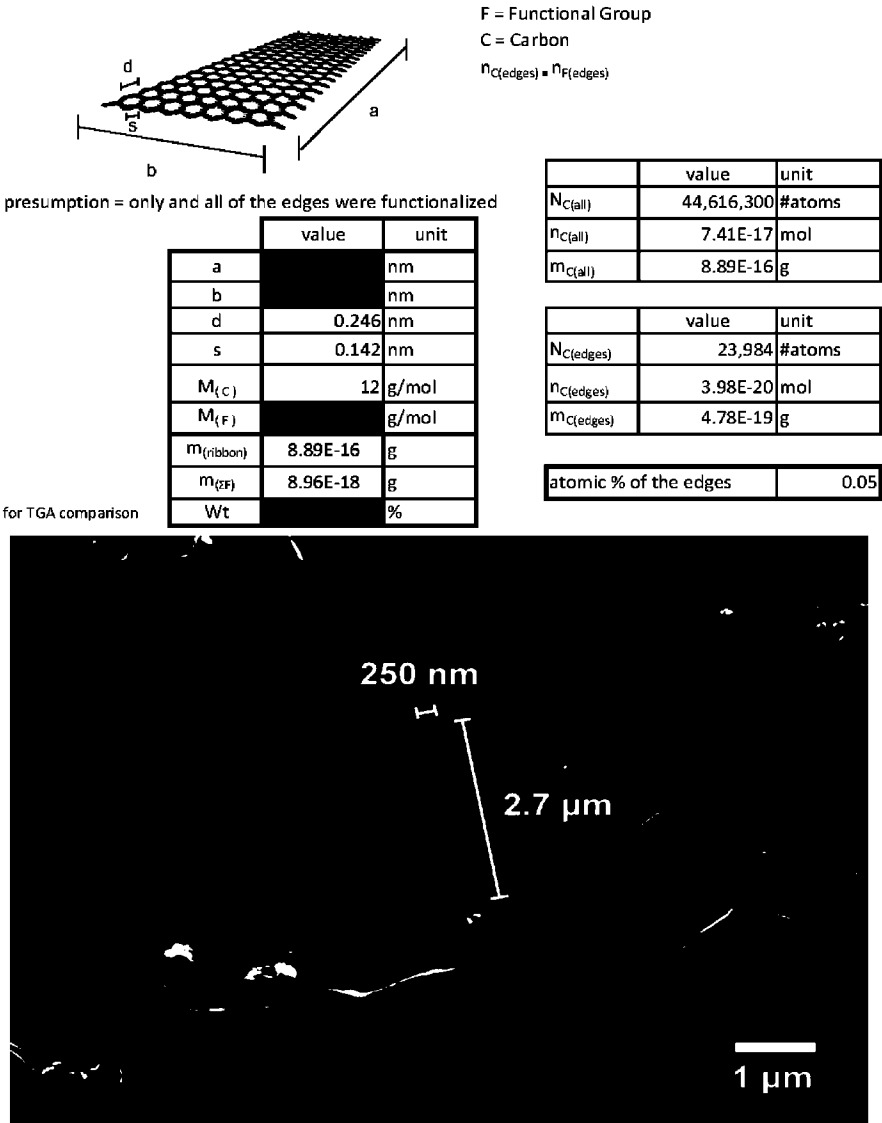


FIG. 10

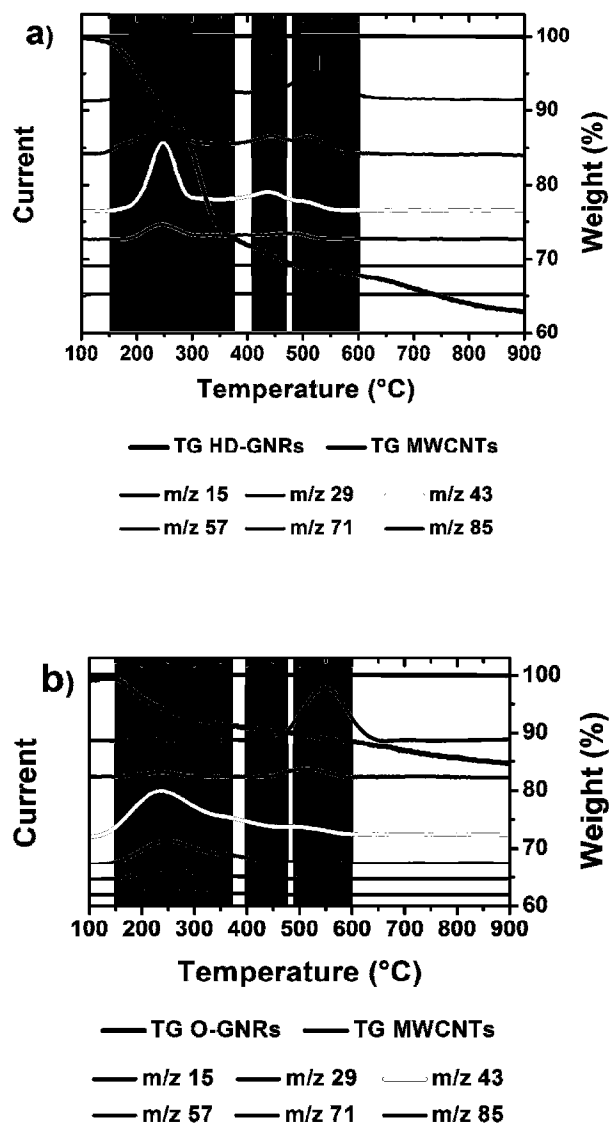


FIG. 11

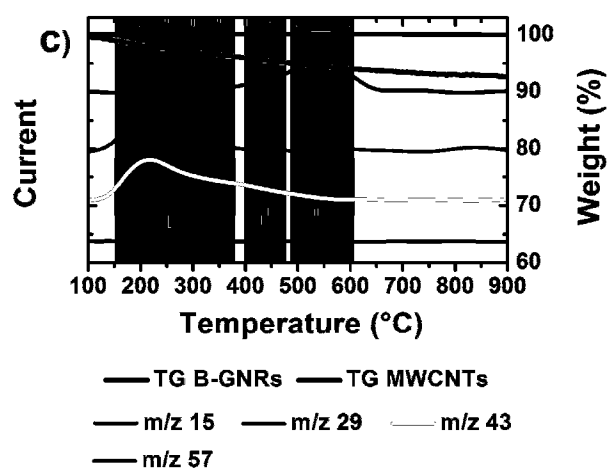


FIG. 11

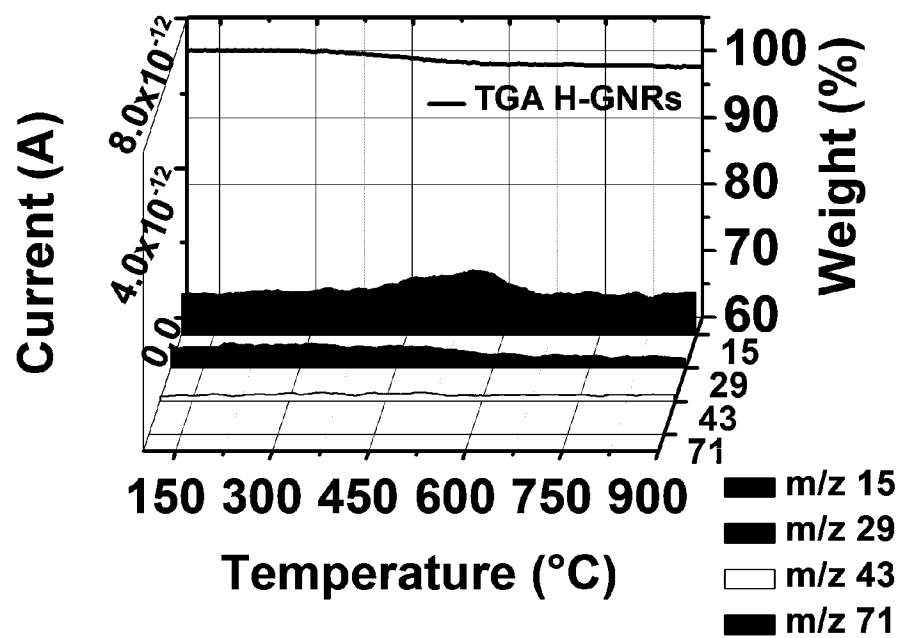


FIG. 12

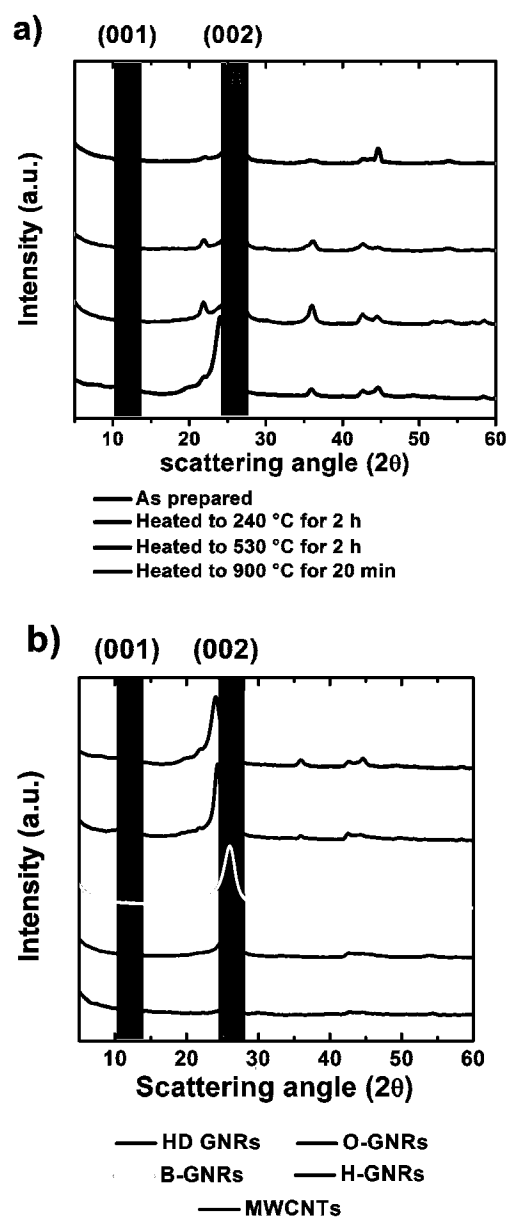


FIG. 13

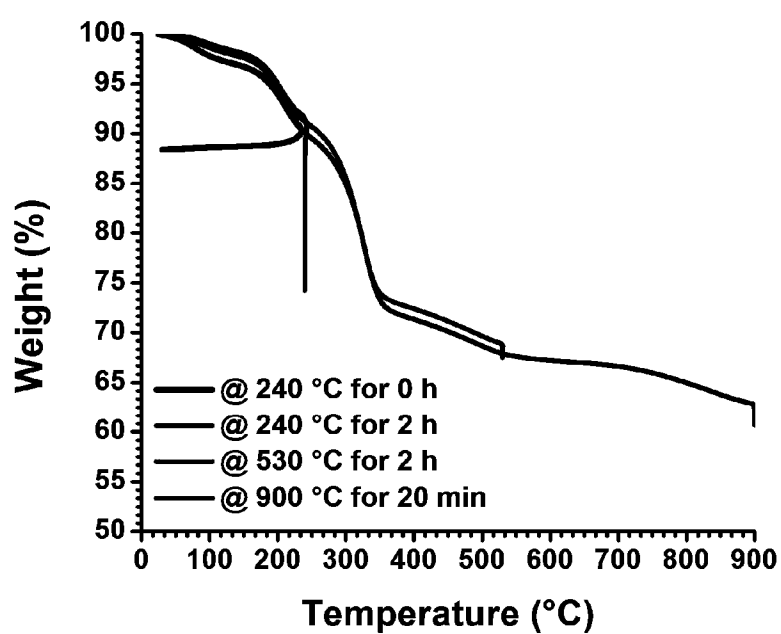


FIG. 14



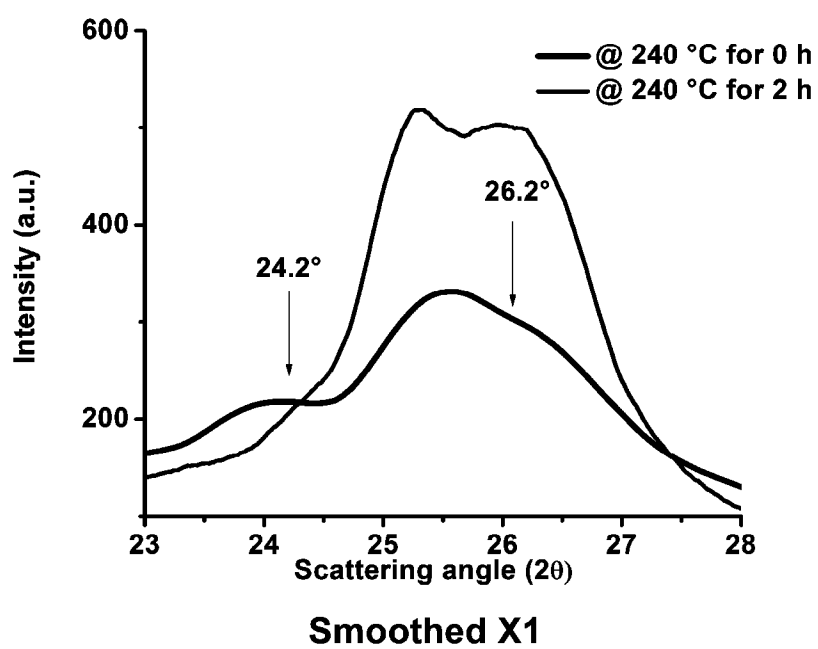


FIG. 15

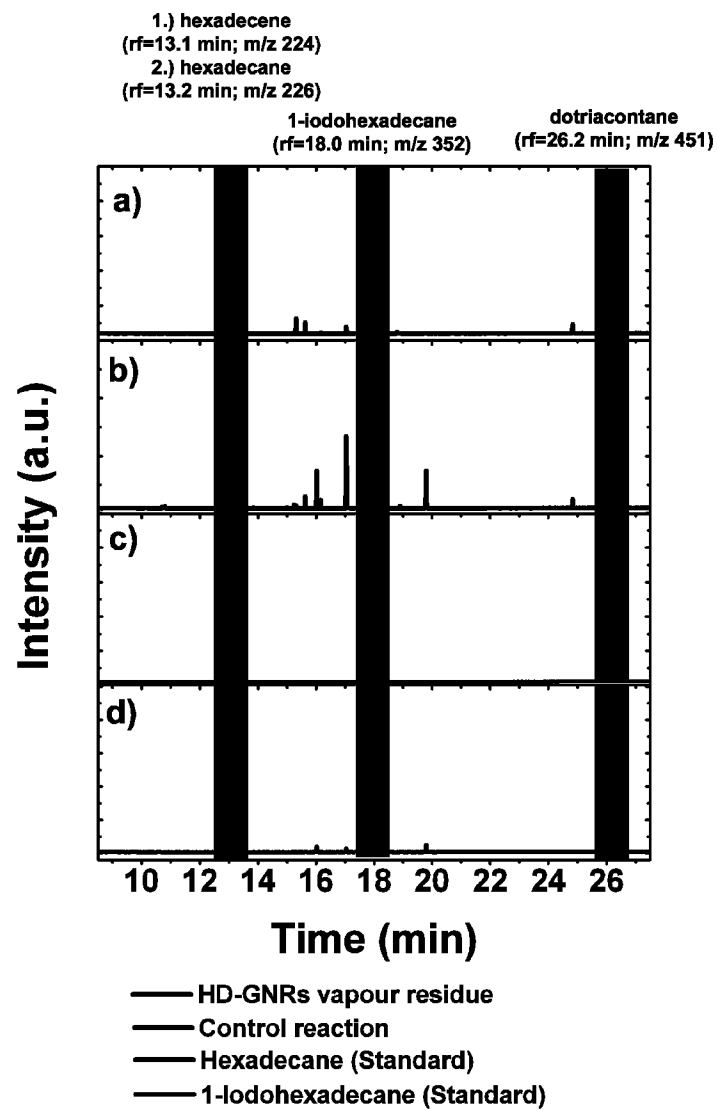


FIG. 16

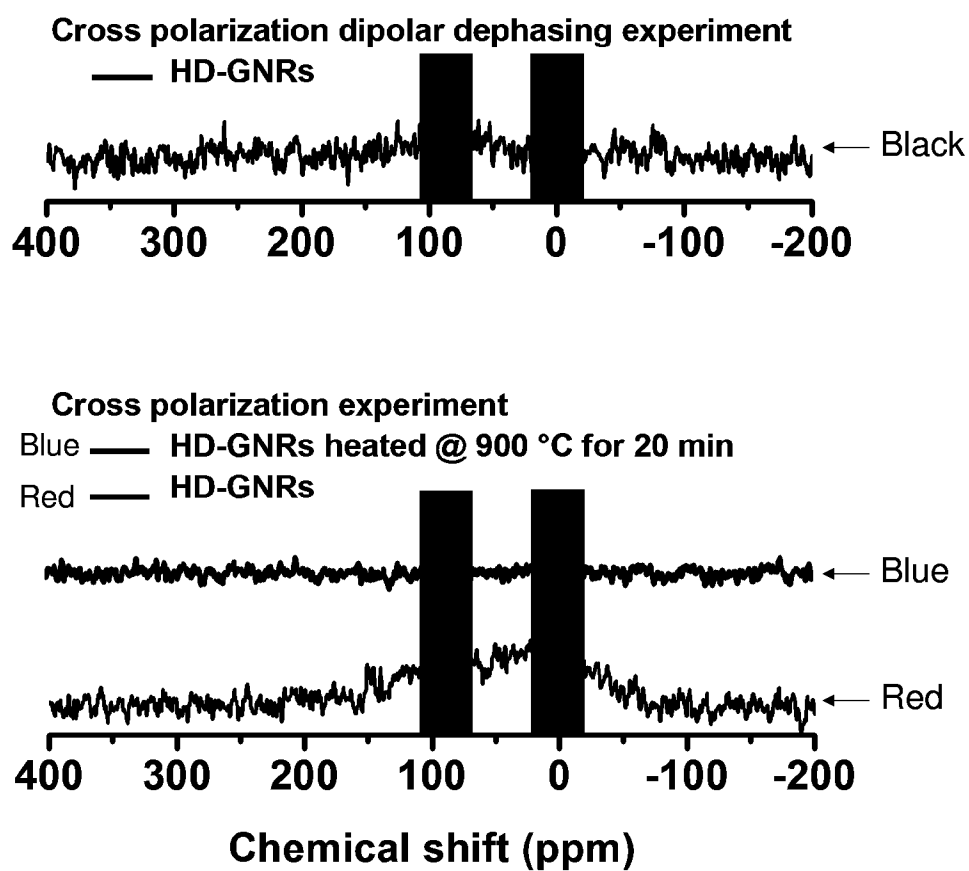


FIG. 17

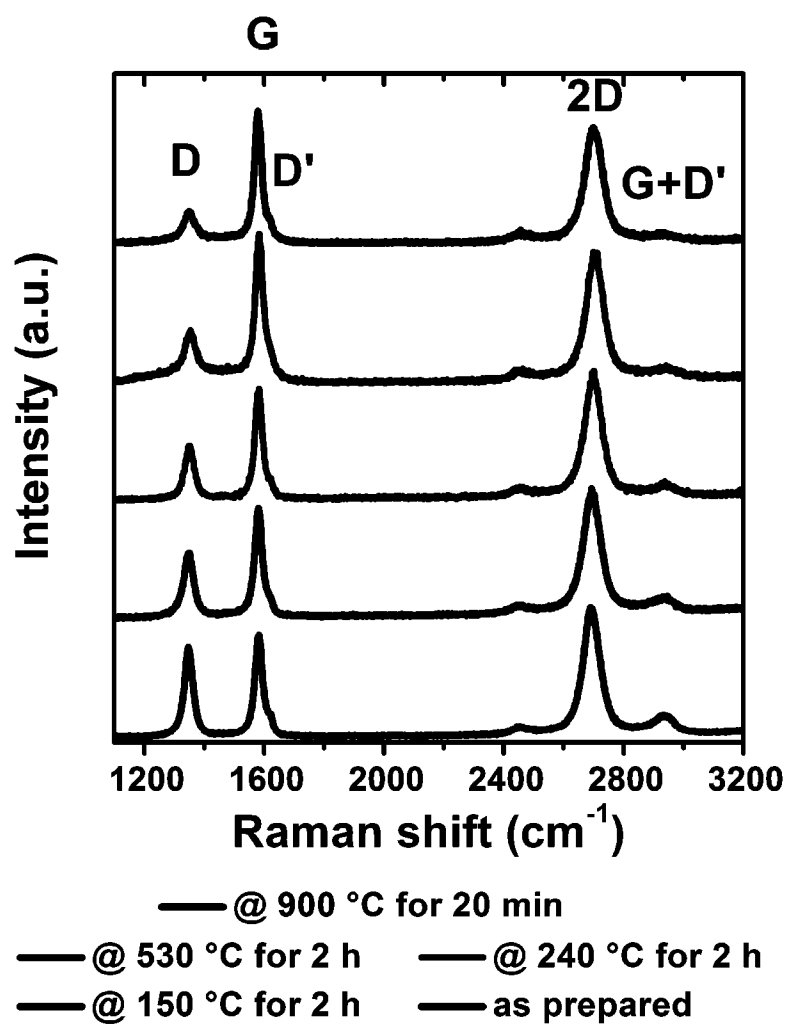


FIG. 18

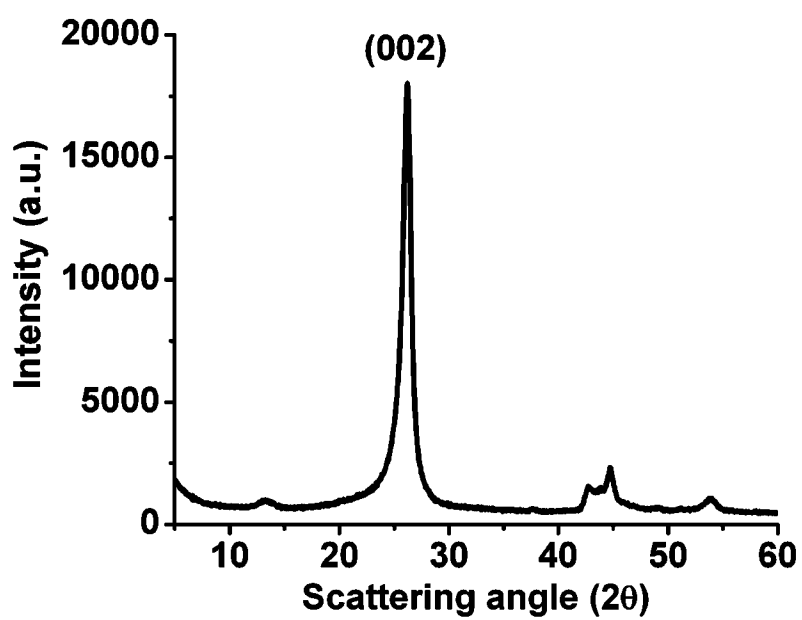


FIG. 19

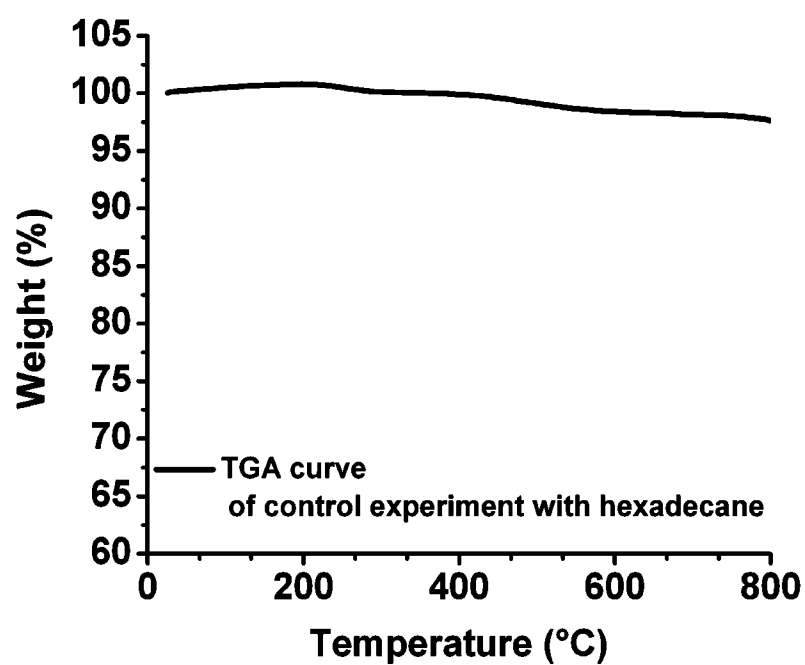


FIG. 20

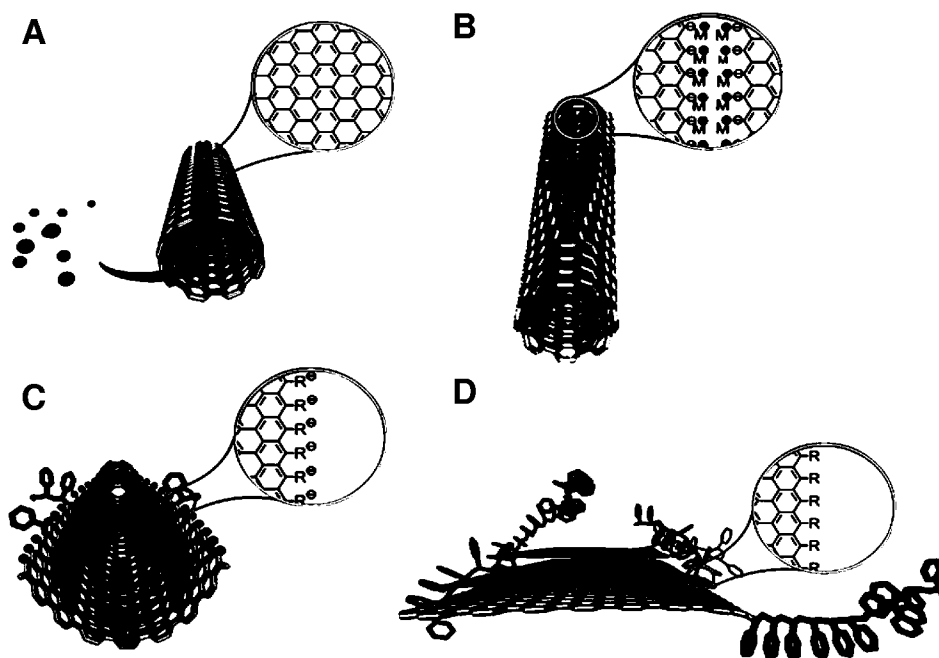
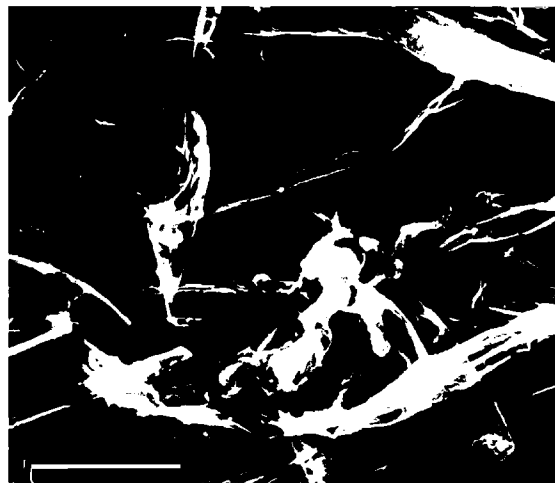
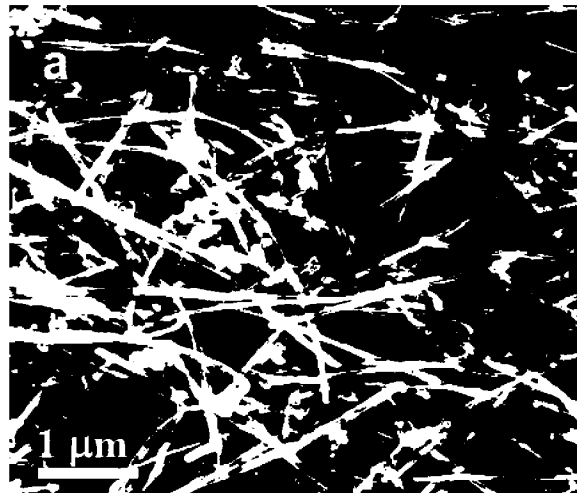


FIG. 21

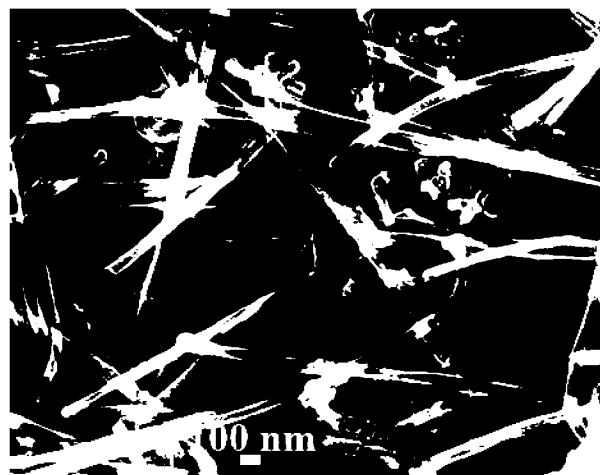


**FIG. 22**



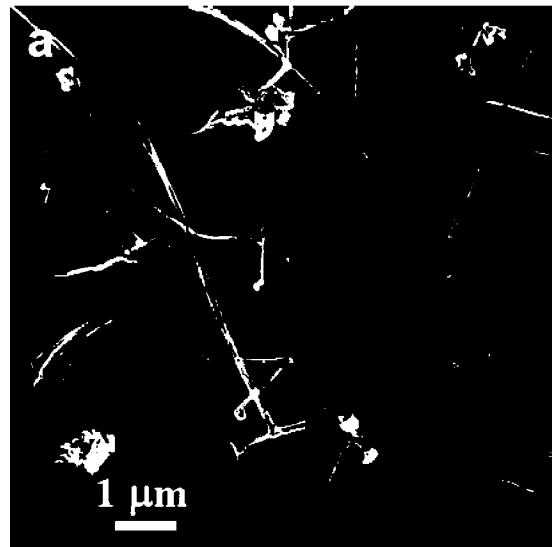


A

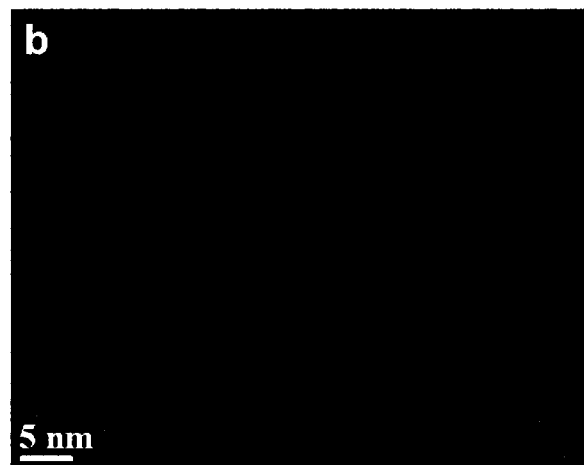


B

FIG. 23

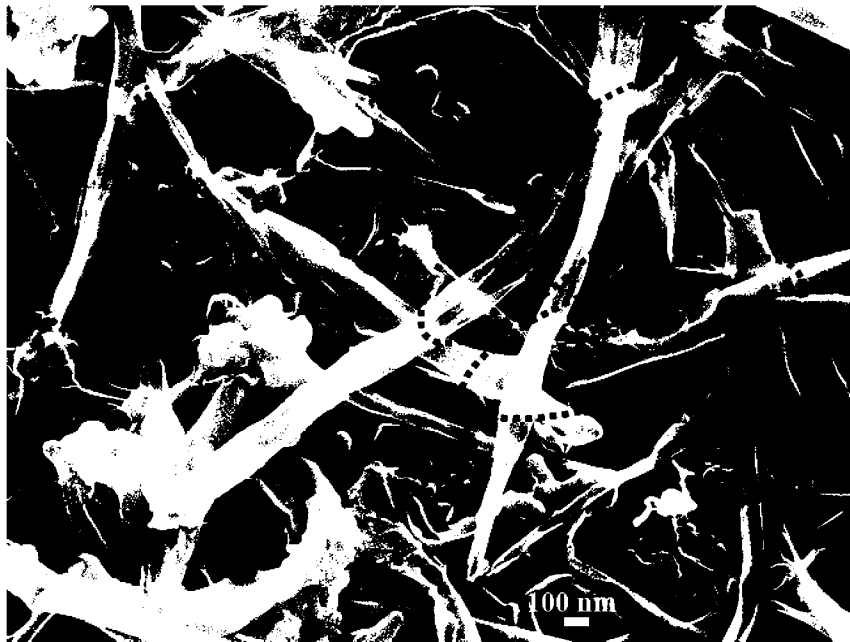


A

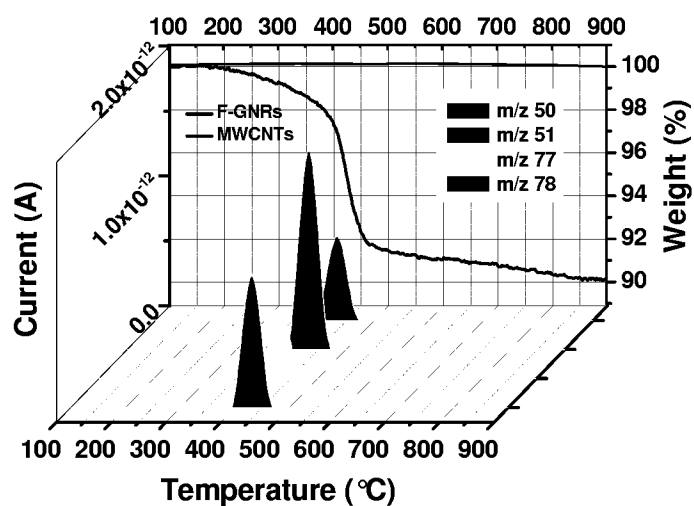


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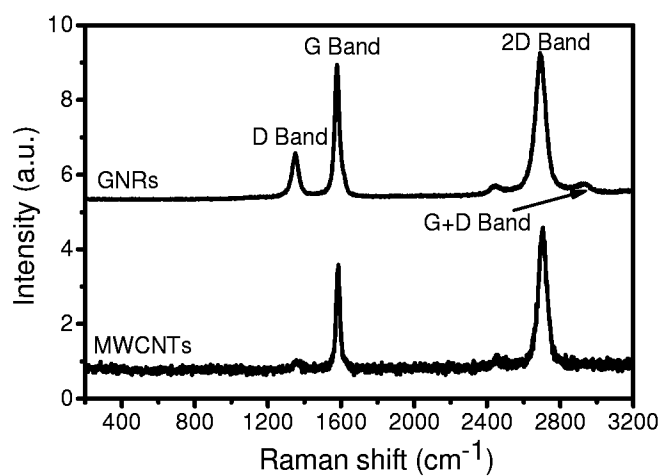
FIG. 24



**FIG. 25**

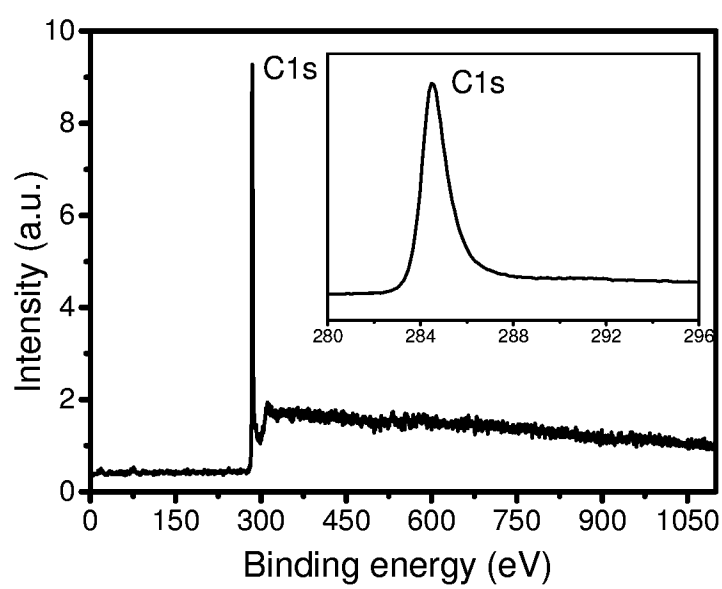


A



B

FIG. 26

**c****FIG. 26**

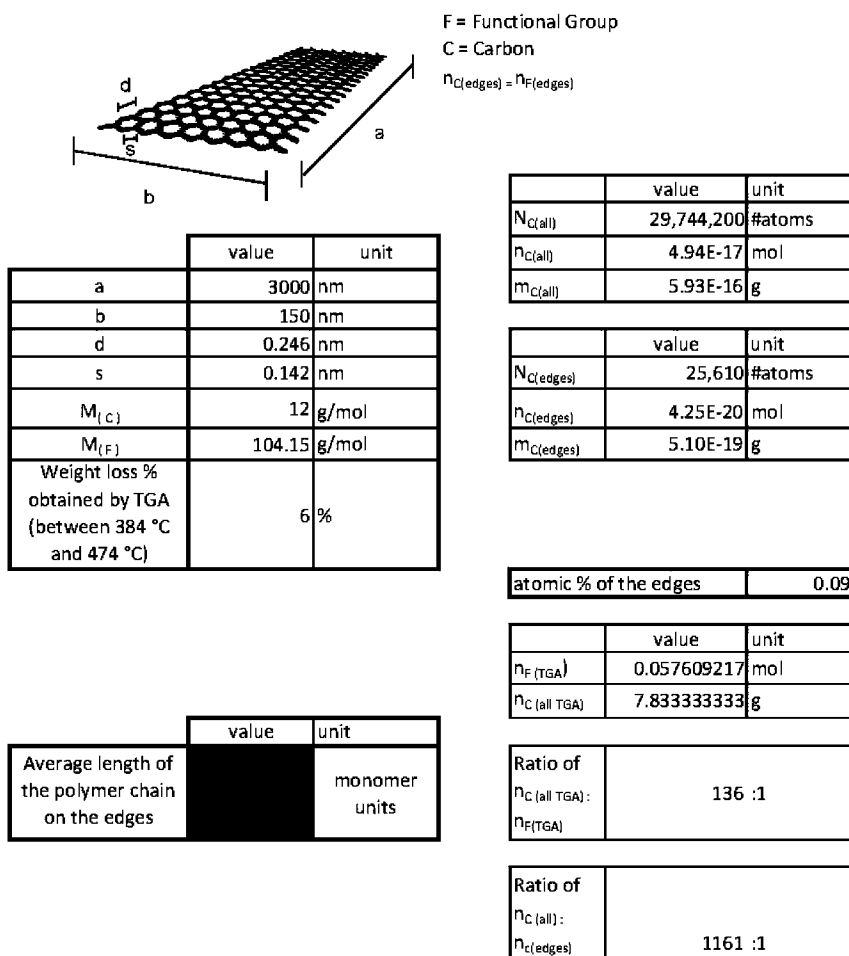


FIG. 27

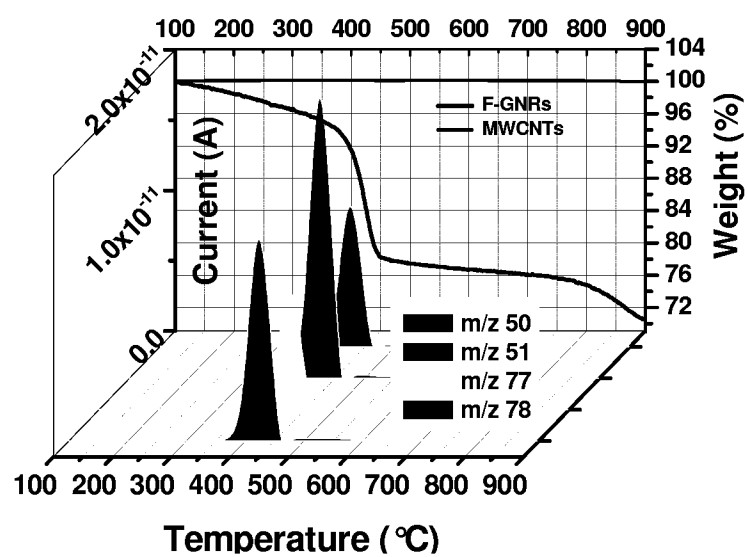


**A**



**B**

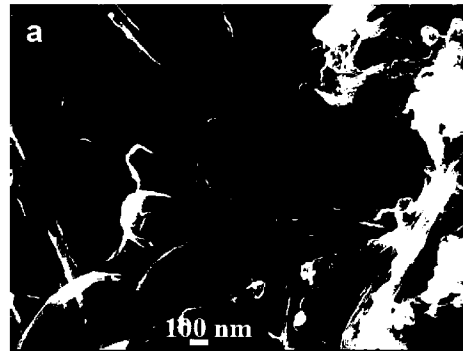
**FIG. 28**



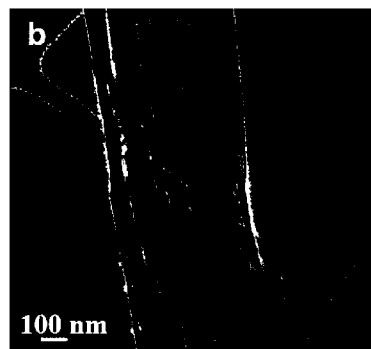
C

FIG. 28

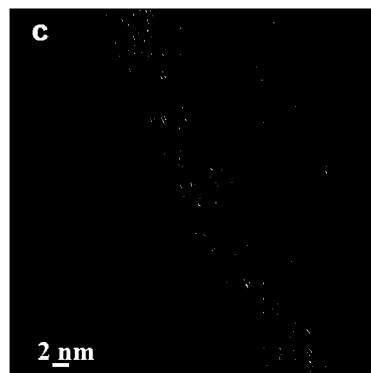




A

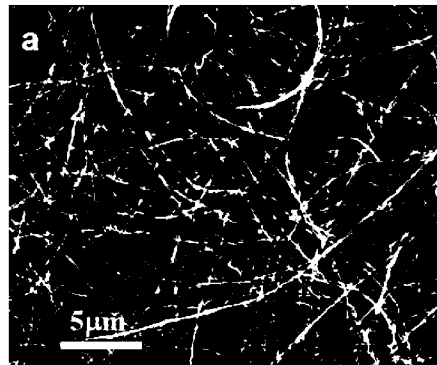


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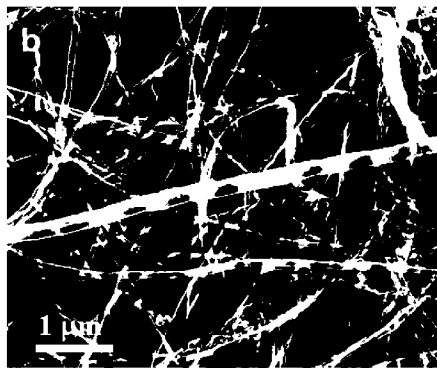


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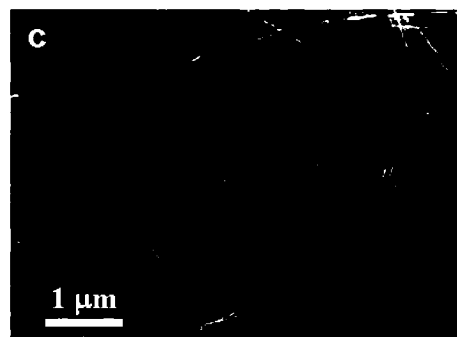
FIG. 29



A

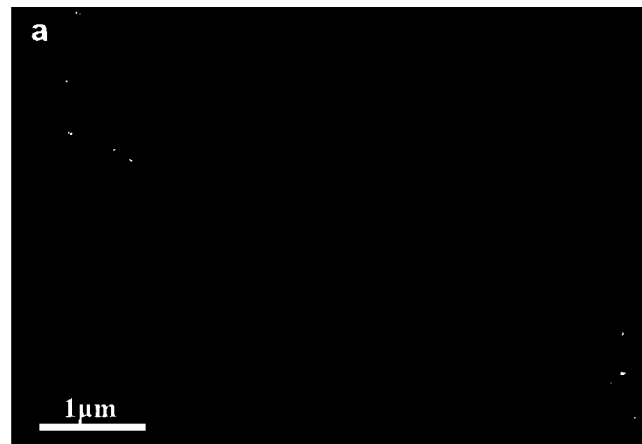


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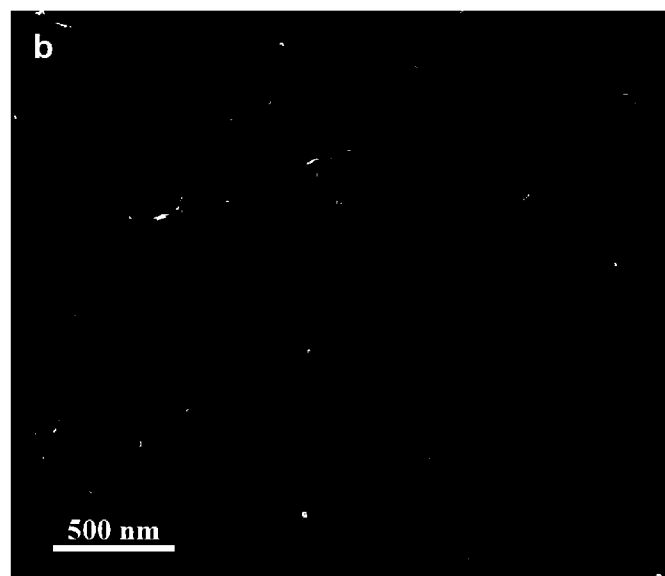


C

FIG. 30



A



B

FIG. 31

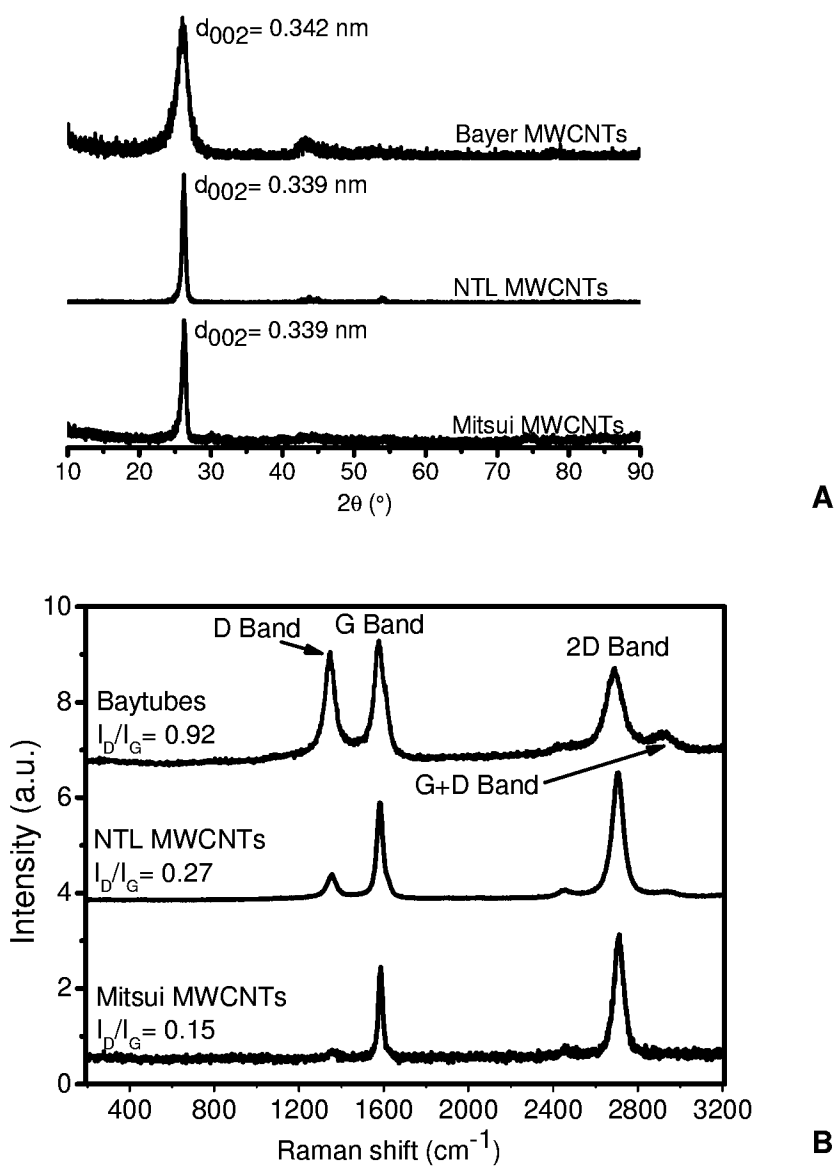
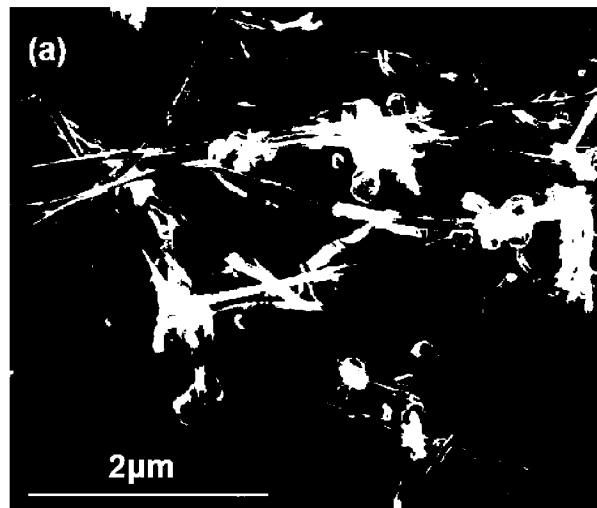
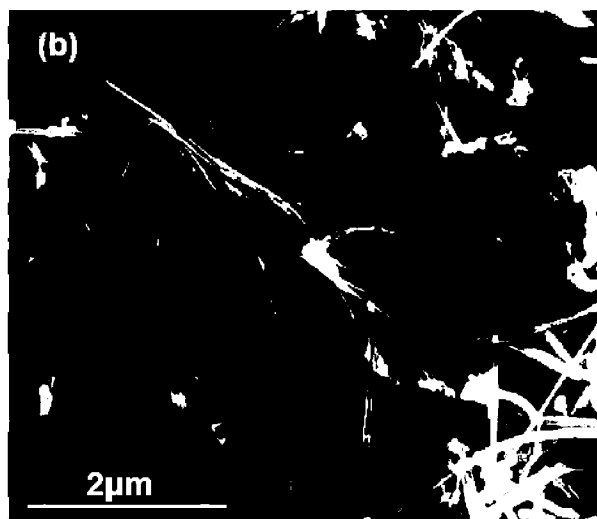


FIG. 32

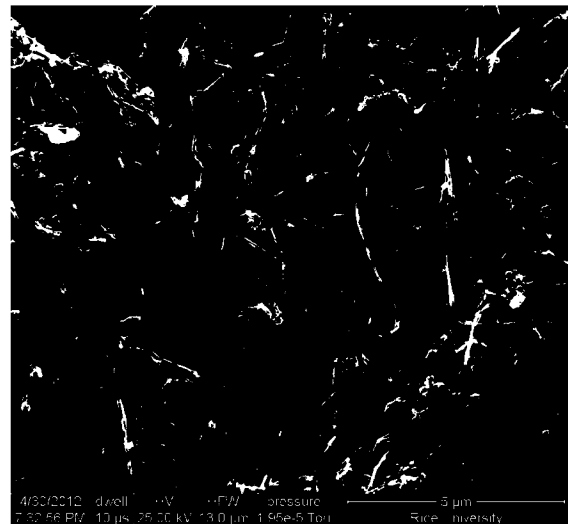


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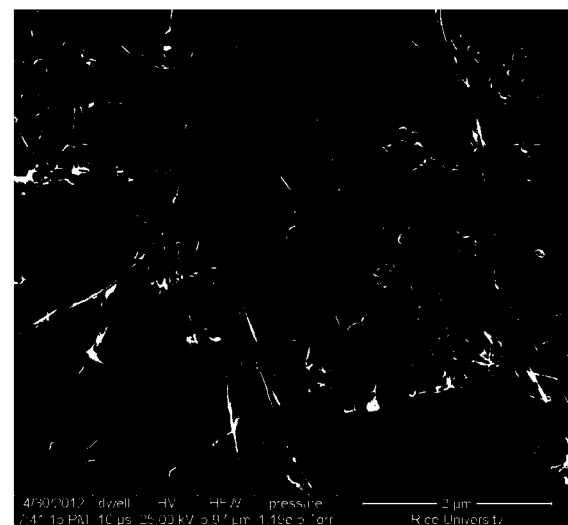


B

FIG. 33

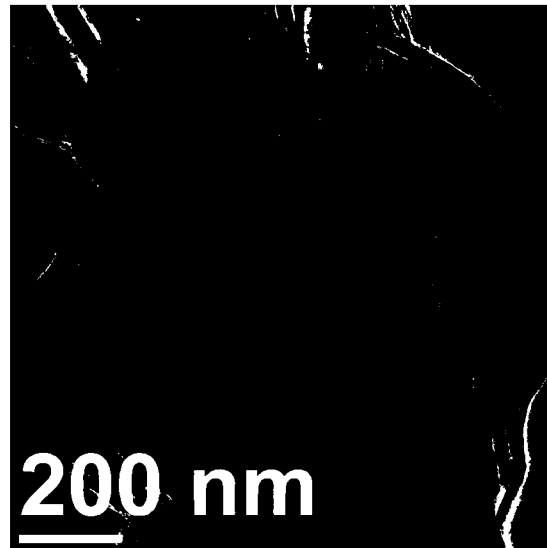


**A**

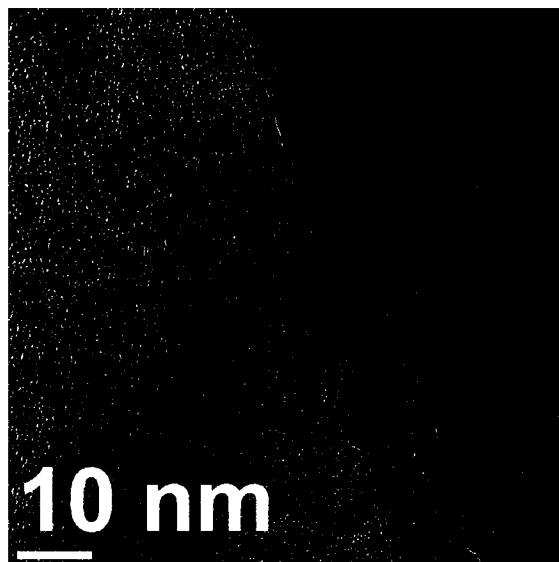


**B**

**FIG. 34**

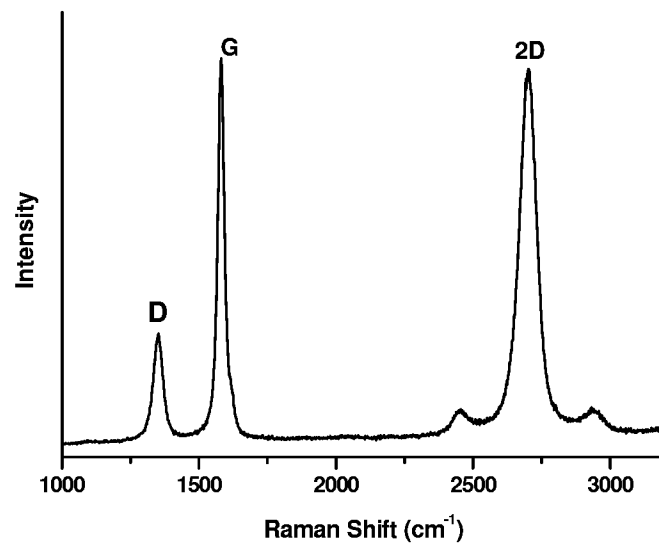


A



B

FIG. 35

**FIG. 36**