



HAL
open science

Electrical conductivity of CNT fibres prepared from spinnable one-step CVD grown vertically aligned CNT

Karim El-Hadj, Ugo Forestier-Colleoni, Soline Allard, S. Ammi, C. Poumarède, Vincent Derycke, Martine Mayne-L'Hermitte, Mathieu Pinault

► To cite this version:

Karim El-Hadj, Ugo Forestier-Colleoni, Soline Allard, S. Ammi, C. Poumarède, et al.. Electrical conductivity of CNT fibres prepared from spinnable one-step CVD grown vertically aligned CNT. Carbon 2019, Jul 2019, Lexington, United States. cea-02329199

HAL Id: cea-02329199

<https://cea.hal.science/cea-02329199>

Submitted on 23 Oct 2019

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Electrical conductivity of CNT fibres prepared from spinnable one-step CVD grown vertically aligned CNT.

K. EL-HADJ^a, U. FORESTIER-COLLEONI^a, S. ALLARD^a, S. AMMI^b, C. POUMAREDE^b, V. DERYCKE^a, M. MAYNE-L'HERMITE^a, M. PINAULT^a

^a NIMBE, CEA, CNRS, Université Paris-Saclay, CEA Saclay 91191 Gif-sur-Yvette France

^b RTE – Paris La Défense, France

e-mail: mathieu.pinault@cea.fr

Due to their exceptional electrical, chemical, thermal and mechanical properties, CNT are particularly appealing as building block of composite fibers, in particular as conducting cables for electricity transport¹. Several studies are reporting the preparation of fibres from CNT² together with the study of their electrical and mechanical properties. However, it is difficult to make a precise comparison between the different types of fibres since they are produced through various processes and with different types of CNT. Our approach consists first in elaborating CNT-based fibres from direct dry spinning of vertically aligned carbon nanotubes synthesized by a one-step aerosol-assisted CCVD process³. Then we measured both the intrinsic electrical properties of the individual CNTs used for fibre preparation and the electrical conductivity of the resulting fibres in order to evaluate the actual benefits of the CNT quality on the fibre performances. By considering several sections of the same nanotubes (with different length) and/or by comparing measurements at both low and high electric field, the impact of metal/CNT contact resistance was determined. The intrinsic CNT conductivity was in the $2 \cdot 10^5$ - $6 \cdot 10^5$ S/m range depending on the Length/Diameter ratio or the CNT crystalline structure. Electrical measurements indicate that the conductivity depends on the spinning process, especially if twisting is applied. The electrical conductivity is about $6 \cdot 10^4$ S/m as compared to the maximum conductivity of the CNT used in these fibres which is around $1.5 \cdot 10^6$ S/m suggesting that the preparation process of such CNT fibres can still be optimized in order to fully take benefit of the CNT intrinsic conductivity.

References

[1] Michael F. L. De Volder et al. Science, 2013, vol.339, 535.

[2] J. Steinmetz et al., Carbon, 2005 ; N. Behabtu et al., Science, 2013.

[3] C. Castro et al., Carbon, 2013, 61, 585-594.