Evolution of Structure of Graphene Oxide with Heat Treatment Temperature

Ludmila Vargas[1], Camila Brito Souza[2,3], Mariany Ludgero Maia Gomes[4,3], Jorge Tadau Matsushima[4,5], Mauricio Ribeiro Baldan[4], Adriana Medeiros Gama[2], Emerson Sarmento Gonçalves[2,1]

[1]Instituto Tecnológico Aeroespacial, [2]Instituto de Aeronáutica e Espaço, Laboratório de Caracterização Físico-Química, Divisão de Materiais, [3]Universidade Federal de São Paulo/São José dos Campos, [4]Instituto Nacional de Pesquisas Espaciais, [5]ETEP Faculdades

e-mail: ludvargas@hotmail.com

Graphene, graphene oxide, reduced graphene oxide are been recognized as an important material for aerospace applications due its exceptional charge transport, thermal and mechanical properties [1]. Much methods to produce graphene and its derivatives can be found in the literature [2,3] and they are been commercialized, but their morphological and structure change considerably depending of which developed process was used to produce them. All variable should be higher controlled to keep the manufacturing process good to apply in the aerospace industry. This paper presents a study using XRD and FT-IR techniques to follow development of crystallographic and chemical structure of graphene oxide produced by Improved Hummers method [2,3], and reduced graphene obtained in a thermal treatment with 400 °C and 1000 °C. It was possible to recognize that functional groups suffered a very important decreasing of their contribution on material, specially carbonyl and hydroxyl groups. Epoxy or alkoxy groups tend to remain in structure. Furthermore, degree of amorphism remains, revealing formation of structure with a few lamellas of graphene.

Acknowledgements:
The authors thank to Andreza M. Cardoso (LCFQ-AMR), Milton F. Diniz (LAI-AQI) and Maria Aparecida M. de Souza (LDFR-AMR) by morphological and structural analysis and to Dario S. Yamagishi (LSIN-AMR) by thermal treatments.

References:

[1] V. Singh V, D. Joung, L.Zhai, S. Das, S.I. Khondaker, S. Seal, Prog in Materials Science 56 (2007) 1178–1271.

[2] D. C. Marcano, D. V. Kosynkin, J. M. Berlin, A. Sinitskii, Z. Sun, A. Slesarev, L. B. Alemany, W. Lu, J. M. Tour, 4 (2010) 4806-4814.

[3] S.Stankovicha, D.A. Dikina, R.D. Pinera, K.A. Kohlhaasa, A. Kleinhammesc, Y. Jiac, Y. Wuc, S.T. Nguyenb, Carbon, 45 (2007) 1558-1565.