European Project NanoMaster Develops Graphene-based Thermoplastic Masterbatches for Conventional & Additive Manufacturing Processes

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Abstract

Graphene-based composites manufactured on a lab scale have been shown to exhibit impressive properties over unreinforced polymers. A small percentage of graphene within a polymer matrix can significantly improve its strength and stiffness, however the material remains prohibitively expensive for large-scale use as a composite reinforcement.Therefore, the concept for this project is to **develop the knowledge-based processing methods required to up-scale the production of graphene and expanded graphite reinforced thermoplastic masterbatches and compounds** and, ultimately, enable its industrial commercialisation in Europe. The work will focus on developing processes for large scale rapid production of graphene reinforced plastic intermediate materials which can be integrated into current conventional and additive manufacturing processes.

The project is led by NetComposites, UK, and involves 12 other project partners: Philips Consumer Lifestyle, Holland, Timcal, Switzerland, Röchling Automotive, Italy, Asociación de Investigación de MaterialesPlásticos y Conexas (AIMPLAS), Spain, Aero Engine Controls, UK, Teknologisk Institut, Denmark, Promolding, Holland, Avanzare InnovacionTecnologica, Spain, Master Build Prototype, France, The Institute of Occupational Medicine, UK, Create It Real Aps, Denmark, and LATI Industria Termoplastici, Italy.

NanoMaster commenced in December, 2011, and has recently produced new grades of expanded graphite and nano-graphite. These are designed to be easier to exfoliate in both chemical and mechanical processes and are also useful when trying to tailor the properties of the final composite for different applications.

Further to this, the project has now used the **new grade of graphite** (plus other commercial grades) **to produce graphene via a multiple-stage chemical exfoliation process** involving oxidative treatment, washing, filtration and reduction. The target is to produce graphene of tailored flake diameter. The process is able to produce these materials at high yield in short reaction times (up to 90% yield in <24 hours).

The next steps for the partners include; scaling up the direct graphene production techniques, developing graphene functionalisation techniques and to begin production of graphene-reinforced powder and rods for use in SLS and FDM, respectively. In addition, because information regarding the potential hazards and exposure routes for nanomaterials is extremely limited, NanoMaster will combine up-to-date surveys of exposure and hazard literature with a workplace questionnaire to give a comprehensive overview of the current status.

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