



One step in-situ graphene oxide reduction in composite

FIST SA

Notre référence :
08107-01

Status des brevets

French priority patent application
n°FR1557277 filed on
July 7th 2015 and
entitled "Procédé et
système pour
l'élaboration de
nanocomposites
polymères/oxyde de
graphène réduit par
réduction in situ d'oxyde
de graphène"



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Status Commercial

Exclusive or non-
exclusive license

Laboratoires

CONTEXT

It is well known that electrical or thermal properties of graphene are of importance in composites for applications like anti-static composites, biomedical, organic electronics, sensors... but the mixing of graphene in polymers is not easy. It has thus been proposed to mix graphene oxide (GO), a graphene derivative which by contrast to neat graphene can be easily processed, with the organic matrix and then to reduce it. This reduction step is performed to restore, at least partially, the properties of graphene. It has a critical influence on the properties of the final material. One reduction route is to heat the composite in order to reduce the GO in rGO but the maximum temperature is limited due to the organic matrix. Other ways like exposition to hydrazine hydrate at 100°C 24h, H₂ plasma or IR xenon flash lamp have been proposed. Each of these having detrimental influence on the final composite and none of these allowing to efficiently restore the graphene properties.

TECHNICAL DESCRIPTION

It is then proposed here to mix the GO with the matrix and then expose said composite to a solvothermal fluid in conditions of temperature T , pressure p , and for a duration t which can be adapted to the matrix. The man skilled in the art knows how to choose the solvent and conditions in order not to negatively impact the matrix nor the graphene. Due to the specific properties of solvothermal fluids they can easily reach the graphene platelets in the matrix, and efficiently reduce them without any negative impact neither on the matrix nor on the rGO. The resultant composites exhibit enhanced properties. The process is low cost, green and easily scalable.

DEVELOPMENT STAGE

Different polymers and loading levels have been tested see table below as example).
Scale up show no difficulty as solvothermal processes are already well known in industry

BENEFITS

Large panel of treatment conditions (fluid, T , p , t) optimised for each composite

Large panel of polymer matrixes

High conductivity of graphene so lower loading needed

No harmful solvent

Composites may be treated as starting blocks but also as final parts ; nothing change in the production process of the composite parts

INDUSTRIAL APPLICATIONS

Any applications where graphene composites have been proposed :

- Conductive composites, paints, inks
- Sensors
- Batteries

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Mots clés :

graphene oxide
composite reduction.

Film	Conductivity (S/m) after thermal reduction 1h 150°C	Conductivity (S/m) after subcritical CO ₂ treatment (150°C, 55 10E5 Pa 1h with N ₂)
GO10% PVA	2.64	29.15
GO10% PEG	0.024	5.84

For further information, please [contact us](#) (Ref 08107-01)
