OPEN ACCESS

Katalyst Publishing Group

Short Communication

Journal of Current Trends in Physics Research and Applications

The Application of Metal Carbon Mesocomposites for the Current Conductive Glues and Adhesives

Kodolov VI[1,2]*, Kodolova-Chukhontseva VV [1,3] and Yu V Pershin[1]

[1]Basic Research – High Educational Centre of Chemical Physics & Mesoscopics, UD, RAS, Izhevsk, Russia

[2]M.T. Kalashnikov Izhevsk State University, Izhevsk, Russia

[3]Institute of Macromolecular Compounds, RAS, StPetersburg, Russia

***Corresponding author:** Kodolov VI, Basic Research – High Educational Centre of Chemical Physics & Mesoscopics, UD, RAS, Izhevsk, Russia; E-Mail: vkodol.av@mail.ru

Received Date: 19 September, 2020
Accepted Date: 06 October, 2020
Published Date: 27 October, 2020

Citation: Kodolov VI , Kodolova-Chukhontseva VV, Yu V Pershin(2020) The Application of Metal Carbon Mesocomposites for the Current Conductive Glues and Adhesives. J Cur Tre Phy Res App 1(2): 111

Abstract

The paper is dedicated to the consideration of the metal carbon mesocomposites application possibilities for the modification of adhesives and current conductive glues. This trend is determined by correspondent peculiarities of content and structure of mesoscopic composites. The main peculiarities of these nanosized particles are following: a) the presence of unpaired electrons on the carbon shell; b) the structure of carbon shell from poly acetylene and carbine fragments; c) the atomic magnetic moment of inner metal is equaled to more than 1–3 µB. The creation of reactive mesoscopic materials with regulated magnetic characteristics which can find the application as modifiers of materials properties, is very topical. The present investigation has fundamental character. It's based on the ideas concerning to the change of metal carbon mesocomposites reactivity. The using is possible as metal carbon mesocomposites both and their modified analogous. The application examples are presented for the properties improvement of polymer compounds such as the current conductive glues and also adhesives.

Keywords: Metal Carbon Mesocomposites, Polymer Compositions Modification, Current Conductive Glues, Adhesive Strength

Introduction

The manuscript is presented as the review of series of papers, manuscripts and patents on the obtaining, investigations and applications of uncials magnetic mesoparticles which are mesoscopic metal carbon composites [1, 2]. The correspondent structure and content of these mesocomposites are caused by the special conditions of their production. In as much as the application of mesoparticles is determined by the properties of these particles which are defined by their structure and content. At the beginning let us consider the initial metal carbon mesocomposite electron structure and correspondent magnetic characteristics (metal atomic magnetic moments, and the spin quantities on carbon shell). The activity of metal-carbon mesoscopic composites are caused by the structure and composition of correspond mesocomposites, which contain the delocalized electrons and double bonds on the surface of carbon shell. Therefore the initial mesoscopic composites are early participated in reactions, especially radical processes and reduction oxidation processes. This activity may be used in modification processes mesocomposites accompanied by the magnetic characteristics changes in modified mesoscopic composites. That development of possibilities processes opens new era for further investigations and development of metal carbon mesoscopic composites application fields. The expansion of metal carbon mesocomposites application chances takes place.

The Glues and Adhesives on the Base of Metal Carbon Mesoscopic Composites

The presence of unpaired electrons and double bonds in carbon shell of metal carbon mesocomposites guarantees the additional conditions for the adhesion increasing especially at the metal materials connection [3]. In these cases the positive meaning has the presence of above mesocomposites magnetic properties. For example, the introduction of Nickel Carbon mesocomposite in the composition of Silver containing current conductive glue leads to the improvement of adhesion and electric conductivity (Fig. 1, 2; Table 1) [4].

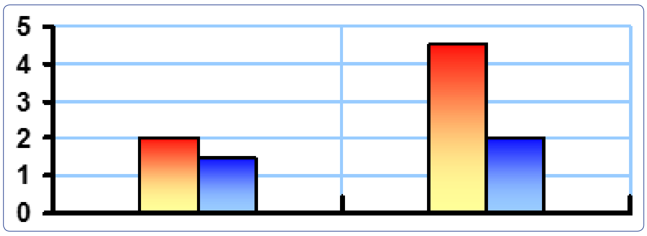

Figure 1: The adhesion durability on shift for Ag containing glue (pink) and paste (blue), initial (a) and modified by Nickel Carbon mesocomposite

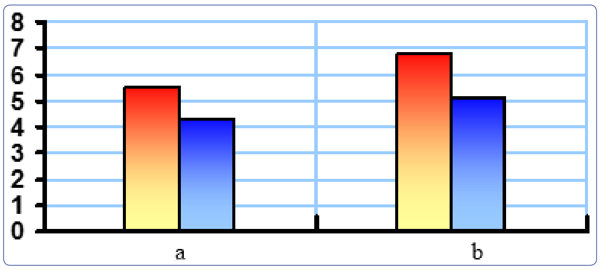

Figure 2: The adhesion durability on separation for Ag containing glue (pink) and paste (blue), initial (a) and modified by Nickel Carbon mesocomposite

Table 1: The measuring results of the current conductive paste (glue) electro resistance, modified by Nickel Carbon mesocomposite

Characteristics	Current conductive paste	Current conductive glue
Specific volume electro resistance, Om·cm (*initial sample*)	2,4·10^{-4}	3,6·10^{-4}
Specific volume electro resistance, Om•cm (*modified sample*)	2,2·10^{-5}	3,3·10^{-5}

Thus, the Metal Carbon mesocomposites can be applied for the improvement of the current conductive materials characteristics.

Analogous results are obtained at the modification of cold hardened epoxy resins by the Metal Carbon mesocomposites. According to the investigation on the modification results of cold hardened epoxy resins the following conclusion may be made: *The test for defining the adhesive strength and thermal stability correlate with the data of quantum-chemical calculations and indicate the formation of a new phase facilitating the growth of cross-links number in polymer grid when the concentration of Cu-C mesocomposite goes up. The optimal concentration for elevating the modified epoxy resin (ER) adhesion equals 0.003% from ER weight. At this concentration the strength growth is 26.8%. At the same time the optimal quantity of Cu-C mesocomposite for elevating the modified industrial epoxy materials adhesion equals 0,005% that leads to the strength growth equals 60.7%. From the concentration range studied, the concentration 0.05% from ER weight is optimal to reach a high thermal stability. At this concentration the temperature of thermal destruction beginning increases up to 195°C.*

The modification of hot hardened epoxy resins by means of Copper Carbon mesocomposites is carried out with the application of the finely dispersed suspension based on iso methyl tetra phtalic anhydrate or based on toluene. After testing the samples of four different schemes, the increase in the strength at detachment σdet up to 50 % and shear τsh up to 80 % takes place, the concentration of Copper Carbon mesocomposite introduced corresponds to 0.0001-0.0003%.

The application of these materials as adhesives for the gluing of metals and vulcanite is realized on the schemes "metal1 – adhesive1 – vulcanite – adhesive2 – metal2" [5]. To define the adhesive tear and shear strengths the above proposed scheme was used (Fig. 3, 4). The investigations carried out revealed that the modification of the conventional recipe of the glue 51-K-45 results not only in increasing the glue adhesive characteristics but also in changing the decomposition character from adhesive-cohesive to cohesive one.

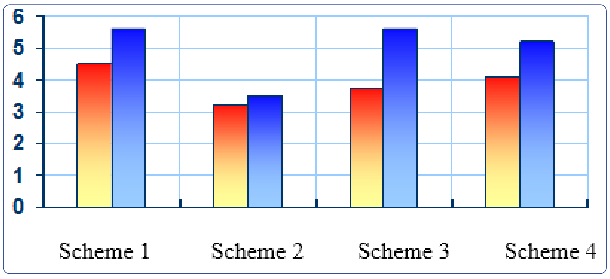

Figure 3: Relative changes of adhesive tear strengths of epoxy glues modified by Copper Carbon mesocomposites (content of MC – 0,0001%)

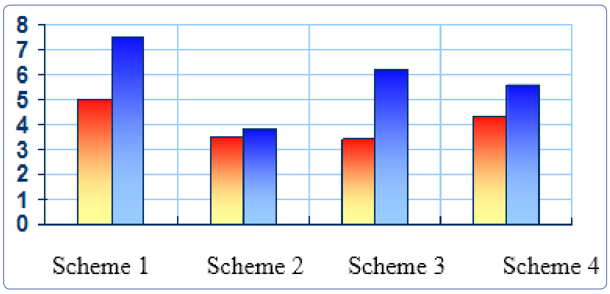

Figure 4: Relative changes of adhesive shear strengths of epoxy glues modified by Copper Carbon mesocomposites (content of MC – 0,0001%)

The availability of metal compounds in mesocomposites can provide the final material with additional characteristics, such as magnetic susceptibility and electric conductivity.

The modification of different materials by minute quantities of Metal Carbon mesocomposite allows improving their technical characteristics, decreasing material consumption and extending their application.

Conclusion

The presented case report is dedicated by the consideration of properties and the possible applications of new class of such mesoscopic particles as Metal Carbon mesoscopic composites and their modified analogs. The unique structures of Metal Carbon mesocomposites are explained by reactivity of Carbon shells which contain the poly acetylene and carbine fragments with unpaired electrons on the joints of fragments. The stability of shells is possible because of the interactions of double bonds, which take place in fragments, with metal clusters within mesocomposites. The increasing of Carbon shell activity is obtained after the reduction oxidation reactions at the modification of initial Metal Carbon mesoscopic composites by reagents containing the positive charged atoms (or oxidizers). These processes as it's established in experiments lead to the shift of electrons on the more high energetic levels and the formation of unpaired electrons that is accompanied by the growth of atomic magnetic moments of mesocomposite cluster metals. These phenomena of structures and energetic characteristics of mesocomposites obtained cause their possibilities for applications in the processes of polymeric composites modification.

The examples of application for the modification of adhesives and glues are presented.

References

1. Kodolov VI, Kodolova–Chukhontseva VV (2019) Fundamentals of Chemical Mesoscopics. – Monograph.- Izhevsk: Publisher – M.T. Kalashnikov Izhevsk State Technical University 218.

2. Kodolov VI, Semakina NV, Trineeva VV (2018) Introduction in science about nanomaterials. – Monograph. – Izhevsk: Publisher – M.T. Kalashnikov Izhevsk State Technical University 476.

3. Kodolov VI, Trineeva VV, Pershin Yu V et al. (2020) Method of metal carbon nanocomposites obtaining from metal oxides and polyvinyl alcohol. Pat. RU 2018122 001.

4. Kodolov VI, Trineeva VV (2015) The metal/carbon nanocomposites influence mechanisms on media and compositions. In Book "Nanostructures, nanomaterials and nanotechnologies to nanoindustry" – Toronto, New Jersey: Apple Academic Press 171-185.

5. Kodolov VI, Trineeva VV (2016) Self organization in processes under action of super small quantities of metal/ carbon nanocomposites. Review on investigation results. – In Book "Multifunctional materials and modeling" Canada-USA: AAP 263-331.