Journal of Medicinal and Chemical Sciences 2018 (1) 9-10

J. Med. Chem. Sci.

Synthesis of polymer-coated RDX/AP nano-composites using supercritical CO_2

Ahmad Sajjadi*, Sayed Mojtaba Moosavi

Departeman of Chemistry, Imam Hossein University, Tehran, Iran

ARTICLE INFO

Article history:
Received 4 May 2018
Revised 14 May 2018
Accepted 16 May 2018
Available online 16 May 2018

Keywords:
RDX
Nano-Composite
Sol gel
CO_2

ABSTRACT

The application of nano-explosives is wide in the field of boosters, propellants and explosive logic networks. RDX, a highly energetic compound used in gun and rocket propellants, is one of the most predominant explosives for the integrated properties. The applications of supercritical fluids as solvents for extracting or separating chemicals are increasing as seen in literature. Application of this technique to make RDX/AP nano-composites is the subject of this work. Structural and thermal analysis of the product was performed by SEM and XRD.

1. Introduction

As one of the nano-material, nano-explosive has the fascinating properties, especially in improving the burning and blast properties of the explosive or propellant, and increasing their mechanical strength. The application of nano-explosives is wide in the field of boosters, propellants, explosive logic networks, et al.[1-2] Nano-composite energetic materials can increase the energy release rate and reduce the sensitivity, which have smaller detonation diameter and very important applications in the field of ignitions train's and boosters.[1]

At present, the main methods to prepare nano-composites energetic materials include sol-gel method, solvent/non-solvent method, spraying evaporation method, mechanical grinding method and freezing evaporation method.

The sol-gel method is a useful approach to prepare nano composites energetic materials.[1] The benefits of this method include the convenience of low-temperature preparation using general and inexpensive laboratory equipment, and easy control over the stoichiometry and homogeneity that conventional methods lack.[2-3]

RDX, a highly energetic compound used in gun and rocket propellants, is one of the most predominant explosives for the integrated properties.[4] Currently a lot of studies are reported for nano-explosives such as RDX, aiming at making improvements in desired properties. The applications of supercritical fluids as solvents for extracting or separating chemicals are increasing as seen in literature.[4-7] Application of this technique to make nano-RDX/AP composites is the subject of this work.

2. Result and Discussion

RDX/AP/RF nano-composites energetic materials are successfully prepares by sol-gel method. The structure of the nano-composites (RDX/AP/RF) was characterized by SEM, FT-IR and XRD spectroscopy techniques (Fig. 1-3).

RF colloidal particles and the size of pores inside the RF skeleton, which assures that energetic materials filled in the pores, are nanoparticles. The SEM image of RDX/AP/RF (Fig. 1) confirmed that the nano-composite was made up of uniform nanometer-sized particles less than 43 nm.

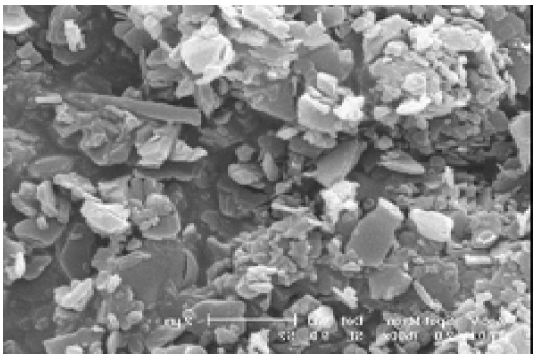

Fig 1. SEM image of RDX/AP/RF nano-composites.

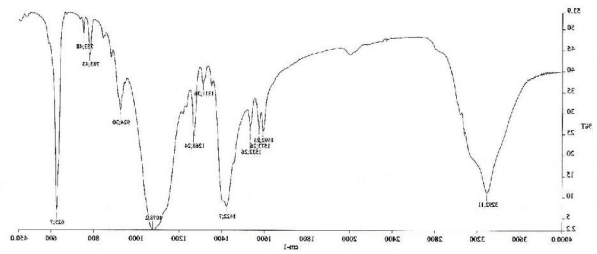

Fig 2. FT-IR spectra of RDX/AP/RF nano-composites.

* Corresponding Author:
E-mail address: sajadiahmad64@yahoo.com (A. Sajjadi)

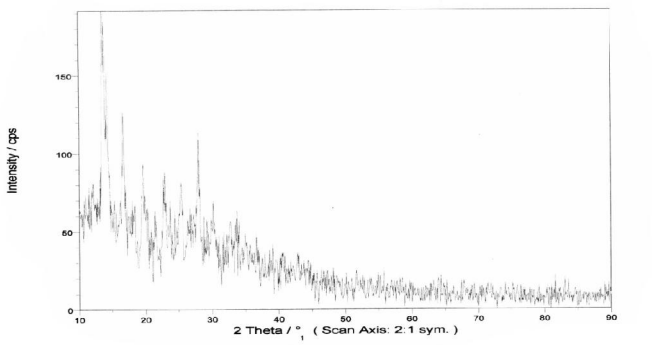

Fig 3. XRD spectra of RDX/AP/RF nano-composites.

4. Conclusion

In this paper, we successfully prepared RDX/AP/RF nano-composites energetic using sol-gel method. The structure of prepared nano-composites was characterized by SEM and XRD spectroscopy techniques.

4. Experimental

4.1. Preparation of RDX/AP/RF nano-composites

To a mixture of Resorcinol (R) and formaldehyde (F) (1:2 mol ratio), Na_2CO_3(.143 g) as a catalyst was added in DMSO (40.0 g). The mixture was stirred to from a solution, and then RDX (3.5 g) and AP (2.5 g) were added to solution. Then RDX and AP were dissolved completely, a lightly yellow sol was obtained. The sols were poured into aconical flask. The flask was sealed and placed in an oven for 5-7 day at 90˚c, then cab - o – sil (4g) were added to form red gels.

The gels were dipped in anhydrous ethanol to obtain ethanol gel. Then the ethanol gels were put into a supercritical drying apparatus, CO_2 was imported into the apparatus. Then the temperature was raised (38-39˚c, 9Mpa) for 4 h to make the CO_2 in the gel form. When the temperature and pressure were decreased to room temperature, RDX/AP/RF aerogels were obtained.

Acknowledgments

I gratefully acknowledge financial support of this work by Imam Hossein University, Tehran.

References

1. R. Ling, M. Yoshida, P.S. Mariano, *J. Org. Chem.* **1996**, 61, 4439.
2. Y. Lan, X. Wang, Y. Luo, *Bull. Mater. Sci.* **2016**, 37, 1701.
3. M. Jin, G.Wang, J. Deng, G.Li, M. Huang, Y. Luo, *J. Sol-Gel. Sci. Technol.* **2015**, 76, 58.
4. R. Chen, Y. Luo, J. Sun, G. Li, *Propellants Explos. Pyrote.* **2012**, 37, 422.
5. G.P. Li, Z.C. Ni,Y.Z. Liu, M. Xia, Y.J. Luo, *J. Therm. Anal. Calorim.* **2018**, DOI: 10.1007/s10973-018-7049-6.
6. V.Y. Dolmatov, A. Vehanen, V. Myllymäki, *J. Superhard Mater.***2017**, 39, 143.
7. J. Zhang, G. Yang, N. Fude, Chin. *J. Energ. Mater.* **2011**, 6, 643.

❖ **How to cite this paper:** A. Sajjadi, S.M. Moosavi, Synthesis of polymer-coated RDX/AP nano-composites using supercritical CO_2. *J. Med. Chem. Sci.* **2018**, 1, 9-10.
Link: http://jmchemsci.com/article_63161.html