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Magnetic graphitic carbon nitride polymers: Solvothermal synthesis as macroscopic samples (nano structure)

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ABSTRACT

In order to prepare C3N4 as macroscopic sample, two synthesis attempts of the graphitic variety were carried out. The first consists on the condensation of melamine and cyanuric chloride (P D130 MPa, T D250±C) with triethylamine acting as solvent in supercritical conditions. The second one consists on the pyrolysis of melamine (P D2.5 GPa, T D800±C) in presence of hydrazine. The two routes led to a graphite-like carbon nitride; nevertheless, the first product is poorly crystallized and contains a larger amount of hydrogen as NHx due to a partial condensation .the sample was studied with UV/VIS and IR and C NMR.

Keywords: synthesis, g-C3N4, catalyst, nanostructure, graphitic carbon nitride.

۱. INTRODUCTION

Carbon nitrides are a class of polymeric materials consisting mainly of carbon and nitrogen.[1, 2]. they can be obtained from carbon materials, through substitution of the carbon atoms by nitrogen, and become appealing candidates for a variety of applications. Like most carbon materials, carbon nitrides also have a long history, which can be traced back to 1834, when a material prepared by Berzelius was named “melon” (linear polymers of connected tri-s-triazines via secondary nitrogen), and reported by Liebig.[3]. However, the potential value of this material was not fully recognized until recent decades, most likely because of its chemical inertness, insolubility in acidic, neutral or basic solvents, and its unrevealed structure.[4]. Graphitic carbon nitride (g-C3N4) is not only the most stable allotrope of carbon nitrides at ambient atmosphere,[5] but it also has rich surface properties that are attractive for manyapplications,[6] including catalysis, due to the presence of basic surface sites.g-C3N4, a stable layered material made of a CN framework with a structure similar to a graphitic nanostructure,[7] has attracted a lot of attention because of the mild conditions required for the synthesis,[8] its stability and highly versatile physical and chemical properties,[9] and its wide range of application possibilities in various fields including catalysis,[10] hydrogen storage,[11] capture and storage of carbon dioxide,[12] water decontamination,[13] solar energy conversion,[14] and even sensing of toxic molecules[15].transformations based on the concept of “Green Sustainable Chemistry”, the development of highly selective reaction systems using heterogeneous catalysts is greatly desired. Heterogeneous catalytic reactions are of great importance in almost all large-scale chemical conversion, energy production and pollution mitigation processes [16]. It is found that over 90% of all commercial chemical processes involve the use of heterogeneous catalysts, and not exaggeratively, heterogeneous catalysis plays a crucial role in the transformation of the chemical industry towards higher level of sustainability Selective oxidation and hydrogenation are two of the key synthetic steps for the activation of a broad range of substrates, and they are widely used for the productionof either finished products or intermediates. There are various ways to synthesize the graphitic carbon nitride catalyst [17]. Water splitting under visible light irradiation [18-20]. It has been reported that g-C3N4 is a unique support material because of its Lewis base nature [21]. It is mainly composed of incompletely condensed amino functional groups with tertiary and aromatic amines [21]. In addition, it has been known that when metallic elements were incorporated onto the g-C3N4 matrix, delocalized electrons are produced which can be useful for heterogeneous catalytic reactions [22]. Furthermore, the sp2 (C-N) hybridized bond provides good stability towards the g-C3N4 structure, enabling it to tolerate extreme temperatures and chemical environment [20, 22]. The use of copper catalysts for oxidation reactions has been widely reported.Based on the newness and efficiency of the product, the use of melanin and cyanuric chloride can be a good way[23]. The most common precursors used for chemical synthesis of g-C3N4 are reactive nitrogen-rich and oxygen-free compounds containing prebonded C−N core structures, such as triazine and heptazine derivatives, most of them being unstable, difficult to obtain and/or highly explosive. The synthesis of single-phase sp3-hybridized carbon nitrides