Applications of MoS_2 as a Two-Dimensional Material Beyond Graphene

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An article usually includes an abstract, a concise summary of the work covered at length in the main body of the article.

I. INTRODUCTION

The study of nanomaterials is wide-reaching and overlaps many different disciplines of scientific research, from physics to chemistry, materials science, and bio-medical engineering, for example. In the past decade research focusing on two-dimensional materials has rapidly increased compared to previous decades. This swift jump in the amount literature and studies being done on various two-dimensional materials is due to several breakthroughs which occurred in the mid 2000s, the resulting properties of such materials, and their possible and numerous applications which are many sweeping across a wide-range of disciplines both academic and commercial.

The major breakthrough that spurred the plethora of research and interest that now exists on two-dimensional materials and its uses was isolation of a mono-layer of graphene. In 2004 Geim et al. were able to isolate a graphene sheet for the first time [6, 7]. Graphite's existence had been known for several centuries prior and was applied in some mechanical settings [5]. However, it was not until 1985 and the discovery of fullerenes (C_{60}) that there was thought to be the possibility of interesting and beneficial properties of this structure and its subsequent derivatives, assuming that it could be synthesized in large quantities [4]. This discovery, albeit theoretical, led to further studies on various allotropes of carbon and suggested the existence of more structures, such as carbon nanotubes [3]. This previous research paved the way for the Geim et al. results which ultimately began the current boom of two-dimensional materials research.

II. GRAPHENE

A. The Discovery of Graphene

The isolation of mono-layer graphene in 2004 was partly a result of theoretical literature on low-dimensional carbon structures and their proposed unique properties. A motivation behind the possible usefulness of a new two-dimensional material was primarily from the semiconductor industry. The performance of traditional silicon semiconductors had neared its limits and as a result there were several proposed alternatives that were being investigated, such as organic conductors and carbon nanotubes [1, 2, 6].

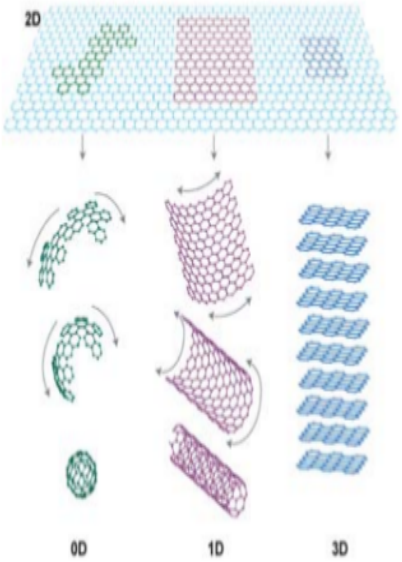

FIG. 1. Test

B. Properties of Graphene

III. TRANSITION METAL DICHALCOGENIDES

A. Properties of MoS_2

IV. SYNTHESIS METHODS

V. APPLICATIONS OF MOS_2

VI. STATE OF THE ART

VII. PROBLEMS AND OUTLOOK

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