הפקולטה למדע והנדסה של חומרים
Department of Materials Science and Engineering

הטכניון מכון טכנולוגי לישראל

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# SEMINAR סמינר

## Synthesis, hydrogen storage and thermal transport properties of Mg - multiwall carbon nanotubes composites


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Hydrogen storage still represents one of the most serious obstacles on the way of widespread using of hydrogen as a clean and environmentally friendly energy carrier. The safest way of storing hydrogen is in the form of metal hydride, since it is reversibly bound to the metal by chemical bonds. Magnesium is considered as one of the most attractive hydride-forming metals for hydrogen storage because of its capability to store reversibly up to 7.6 wt.% of $H_2$ and moderate costs. However, slow $H_2$ absorption/desorption kinetics, high hydride formation enthalpy and poor thermal conductivity of magnesium hydride phase ($MgH_2$) are the main drawbacks that prevent its use in hydrogen storage. These issues are interconnected: low thermal conductivity slows down the heat flow that influences the rate of hydrogen absorption/desorption. Thus, the ability of the two-phase Mg- $MgH_2$ mixture to conduct heat often represents the kinetic "bottleneck" determining the hydrogenation kinetics.

It has been shown in the literature that combining magnesium with multiwall carbon nanotubes (MWCNTs) can accelerate $H_2$ absorption/desorption kinetics. Yet the mechanisms of this acceleration remain unclear. We produced Mg+MWCNTs composites using the high energy ball-milling (HEBM) process. This method results in dispersion of the MWCNTs in Mg matrix accompanied by the changes in their morphology and properties. We studied the influence of ball milling parameters on the morphology, microstructure, hydrogenation kinetics, and thermal conductivity of the Mg – MWCNTs composites. It was found that although prolonged ball milling leads to a partial destruction of the MWCNTs, it has a positive effect on the thermal conductivity of the compacts in the hydrogenated state. We related this improvement of thermal conductivity to the chain-like anisotropic arrangement of carbon nanoparticles formed after prolonged milling, and resulting percolating microstructure of the two-phase Mg- $MgH_2$ mixture. We also demonstrated that insufficient de-agglomeration of the MWCNTs during initial stages of ball milling results in reduced porosity of Mg particles and slows down the kinetics of hydrogenation.


**Advisor: Prof. Eugen Rabkin**

**ההרצאה תתקיים ביום חמישי , ה-31 במאי 2018 בשעה 14:30**
**באודיטוריום ע"ש דיוויד וואנג, קומה 3, בנין דליה מידן**

**The lecture will take place on Thursday, May 31th, 2018 at 14:30**
**David Wang Auditorium, 3rd floor Dalia Maydan Bldg.**

**כיבוד קל יוגש לאחר הסמינר**