IMPACT: International Journal of Research in Engineering & Technology
ISSN (P): 2347–4599; ISSN (E): 2321–8843
Vol. 9, Issue 1, Jan 2021, 23–28

DEVELOPMENT OF HYDROGEN STORAGE TECHNOLOGIES IN AUTOMOBILES

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Received: 11 Jan 2021 **Accepted:** 17 Jan 2021 **Published:** 31 Jan 2021

ABSTRACT

Fuel cell vehicles have possibleness to reduce emissions & energy consumption. In future, the Mother Nature carries harmless energy like hydrogen (H_2) will play critical role. Hydrogen storage is the key technology towards the hydrogen society. In previous years, the viable storage of hydrogen in various ways extensively measured. In this paper, is prior study present and featured hydrogen storage materials and high-pressure tank systems, other composite compounds as a hydrogen storage. Future some hydrogen materials worn for hydrogen storage are ammonia borane (MBH4), hydrides, amides, composite materials, metal -organic, organic molecules etc. light metal alloys, up to now we focused on review afterwards wholly on experimental studies. Also be presented the key characteristics of materials, properties of decomposition rate, hydrogen content, purity and recent trends in development of original materials with high hydrogen storage capacity.

KEYWORDS: *Ammonia Borane, Hydrides, Amides Etc*

INTRODUCTION

Hydrogen storage materials are having great synergy with hydrogen or without any reaction needed. The present hydrogen is primarily due to Mother Nature concerns of harmful emissions from the relic fuels. Also, a summons for efficient power sources has expanded the interest in different kinds of new technologies, such as fuel cells, electrical batteries using hydrogen. In future the hydrogen (H2) will become the means of storing and transporting energy, Mobility is one of the human beings and fundamental desire it is the challenge of movement everywhere in the world and it will be expand further in the future, It is should be clean and safe as well as in expensive, The expand of movement mainly come from automobiles raises environmental concerns such as carbon dioxide emissions and global warming. More than a 100years ago, lighter element hydrogen as an alternative to be a traditional (or) conventional fount such as oil, natural gas, coal etc., has been the focus of research and development in all technologies at advanced countries of the world. Hydrogen can be produced from a variety of sources including fossil fuels, renewable energy & water. It is non-toxic and extremely mother nature since water is the only exhaust part when hydrogen is converted into energy. Infrastructure of economy of hydrogen is made up of five elements such as production, delivery, storage, conversion, while the hydrogen production & conversion are already feasible, Therefore, other points which as connect with natural gas, a compressed gas or cryogenic liquid portage as well as alternative hydrogen using ammonia borane (MBH4),hydrides, amides, composite materials, metal-organic, organic molecules etc. These results which are obtained by many days and studies shows that three kinds of materials are metal hydrides, Boron -Based materials, ammonia Borane -Based of are used in hydrogen storage process.

INVESTIGATION OF VARIOUS MATERIALS:

The greatest dispute of materials and compounds were discovered & developed, the presently storing method of hydrogen on-board is nearly 300 mile range. In future ammonia borane is promising for hydrogen storage and it is volumetric and gravimetric dispute density of the hydrogen as a material, and they are some technical challenge are Enhancing the rates of hydrogen storage materials and the economical-chemical dispute pathways that will be used to put the hydrogen back of the dehydrogenated materials.

Ammonia Borane

Formation energy /atom –(-0.430ev), Band gap is 6.007 EV, Crystal system is monoclinic. These materials are used for hydrogen storage material device. It is also called as Borazine, and it is a boron -nitrogen-hydride compound, complex geometry is a tetragonal at B and Colorless crystal,

Figure 2 shows Ammonia borane material is used for Ionic liquids salts. The salts are having some properties such as a) negligible, vapor pressure,2) stable evaluated temperatures3) dissolve wide range of compounds & gases. The above graphs show the absorption coefficient vs energy graph and Intensity vs electrons.

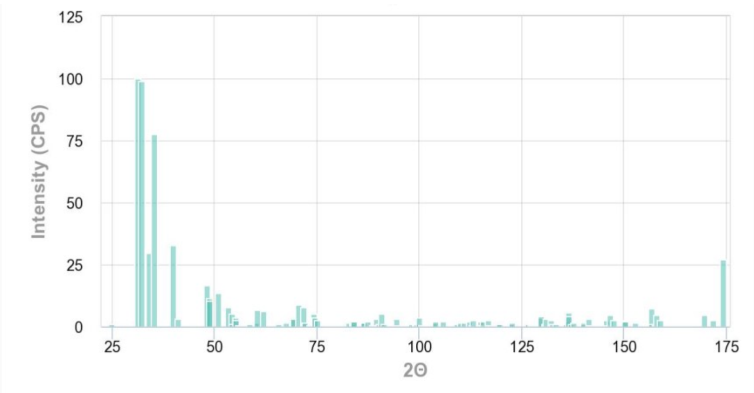

Figure 1: Intensity Vs Atoms of Ammonia Borane

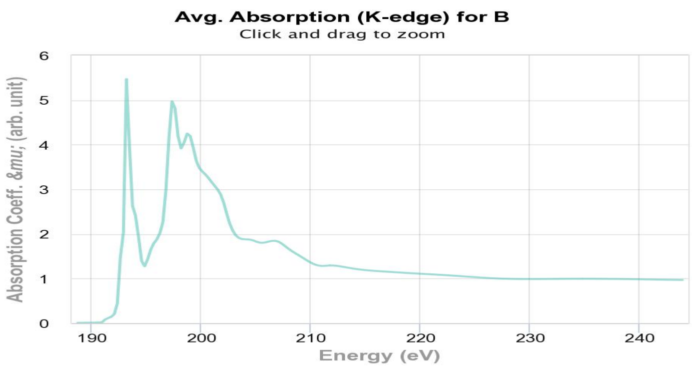

Figure 2: Energy(eV) vs Absorption Coefficient of Ammonia Borane.

Metal Borohydrides

Chemical group of borohydrides is M(BH4) $_n$ calcium borohydrides and lithium borohydrides.$Ca(BH_4)_2$ has very low gravimetric hydrogen storage capacity and but volumetric Capacity is more than that of LiBhH4,the hydrogen storage materials are have more temperature of dehydrogenation, lack of reversibility & dehydrogenation LiBH4 has 3:1 silica powder is substantially decreased its decomposition temperature. Borohydride formation of the reaction the hydrogen(H2) with boron hydrides of Li, mg etc. and Ba at 600-700^{O}c, (Formation energy-0.457ev,Density-1.02gcm3,Band gap is 5.311ev,for energy above -0.004ev,energy cut off is -520ev.

Figure 4 shows the absorption coefficient vs energy and the band width will be high compare to hydrides and amides. The intensity also high compares both hydrides and amides.

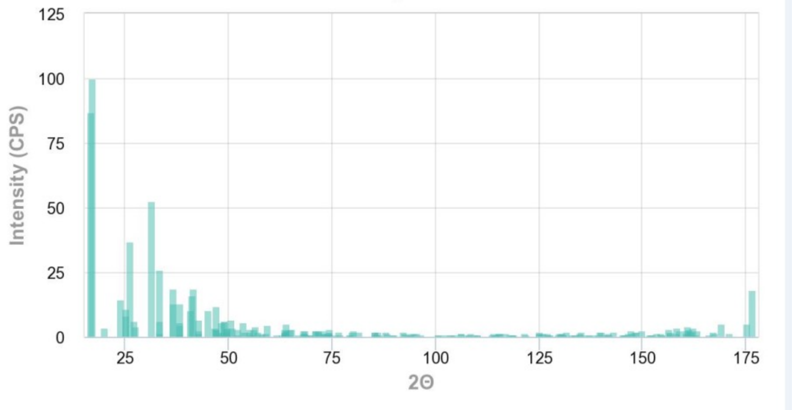

Figure 3: Intensity vs Atoms of Borohydrides.

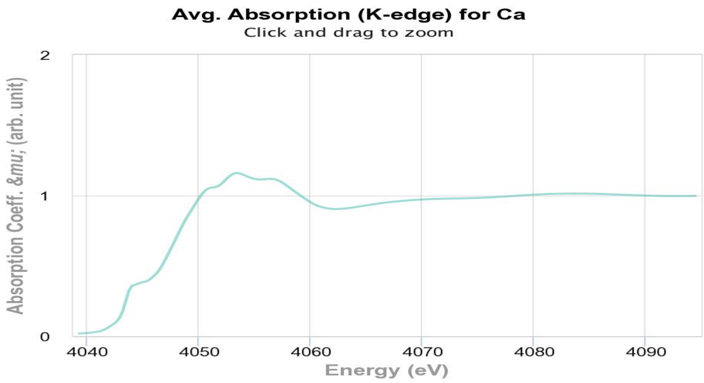

Figure 4: Energy vs Absorption Coefficient of Borohydrides.

Metal Hydrides

Ca (H2)-It can be synthesized by the solid gas reaction of hydrogen with a metal, it consists of metal (or) metalloid bonded hydrogen. Metal hydrides are modified by the nature of the chemical bond (ionic, metallic (or) covalent) between hydrogen & as a metal. It has a solid state of aluminum & boron -based hydrides is quite in the chemical solution. CAH2 formation energy is -0.659 eV, density is 1.96 g/cm3 and the band Gap is 3.008 ev.

Table 1 shows some properties of data which are like molecular formula, molecular weight, density etc. In future I think hydrogen gas as the clean fuel of the nature and it can generated from water, returning to water when it is oxidized, Hydrogen powdered fuel cells are increasing day by day as 'pollution -free ' sources of energy and are now being used in some buses & cars.

Table 2 shows compare to the lightweight elements of metal hydrides, amides, and borohydrides the percentage of hydrogen is more in amides. So we can storage the hydrogen more in amides compare to others, the transportation and manufacturing is also very simple.

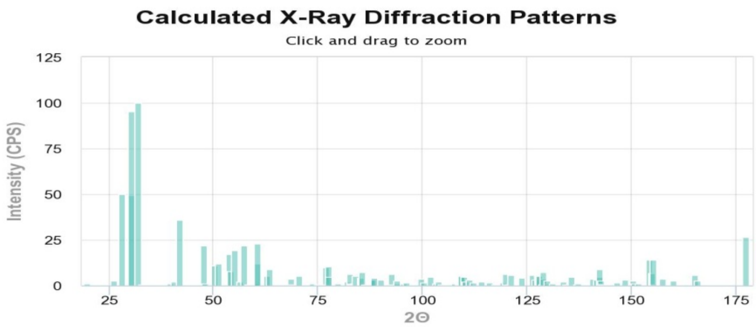

Figure 5: Intensity Vs Atoms of Hydrides.

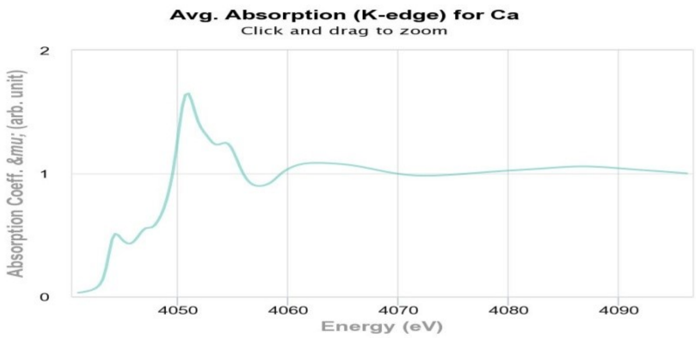

Figure 6: Energy Vs Absorption Coefficient of Hydrides.

Table 1: Properties of Hydrogen Storage Materials

S. No	Material Name			Properties				
		Molecular Formula	Chemical Formula	Molecular Weight	Cas No	Density Mg/Ml	Melting Point	Freezing Point
1	Ammonia Borane	NH3-BH3	BH6N	30.865	13774-81-7	780	104.7	97.61
2	calcium Borohydride	CA(BH4) 2	-	69.76	17068-95-0	112		
3	lithium Borohydride	li (BH4)	-	21.78	16949-15-8	680		
4	calcium hydride	CAH2	-	42.09	7789-78-8	-	816	
5	lithium hydride	LIH	-	7.95	7580-67-8	820	692	
6	lithium amide	LINH2	-	22.96	77-82-89-0	1.18	390	
7	sodium amide	NANH2	-	39.01	7782-92-5			

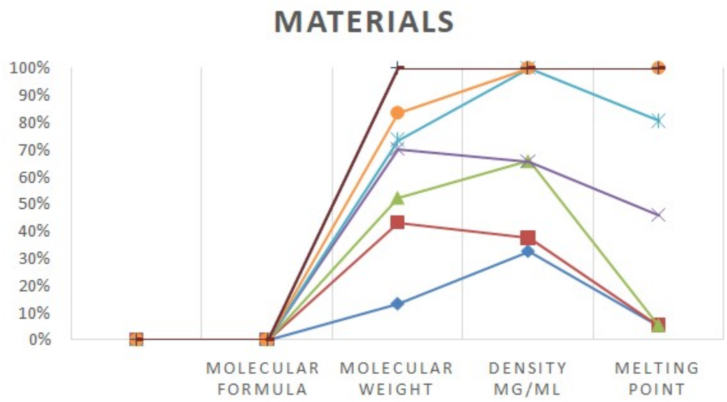

Figure 7: Percentage of Materials.

Table 2: Properties of Materials with Hydrogen Content and Decomposition Rate

S. No	Material Name	Properties			
		Formula	Hydrogen Content	Purity (%)	Decomposition Rate©
1	calcium hydride	CAH2	8.7	>95	LI2NH>350
2	lithium hydride	LIH	5.1	>95	500
3	lithium amide	LINH2	12.6	>95	720
4	sodium amide	NANH2	4.7	>95	600

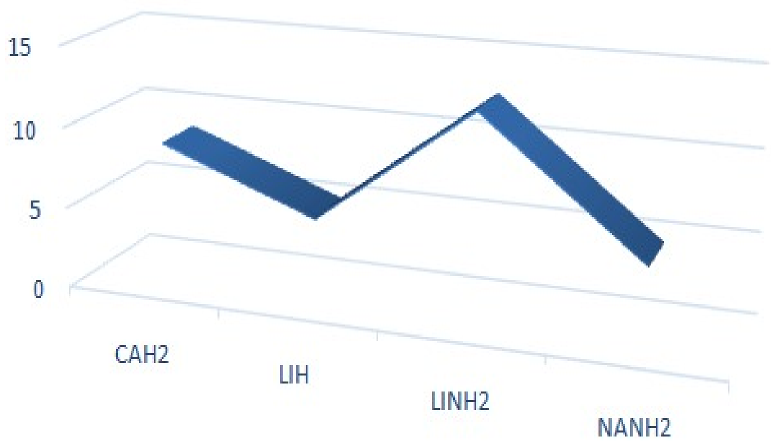

Figure 8: Properties with Hydrogen Content.

CONCLUSIONS

During studies the material science dispute of hydrogen storage device is to be venture the combination of hydrogen with other elements such as better, epically metals complex compounds are like Ca(H2), LIH, Ca(BH4)2 have been described and latest compounds of very light weight metals and the hydrogen will be discovered. The hydrogen storage, production and conversion have reached a high- technological level. At last we find out that hydrogen content is more in amides groups.

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