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Precious Metals Chemistry

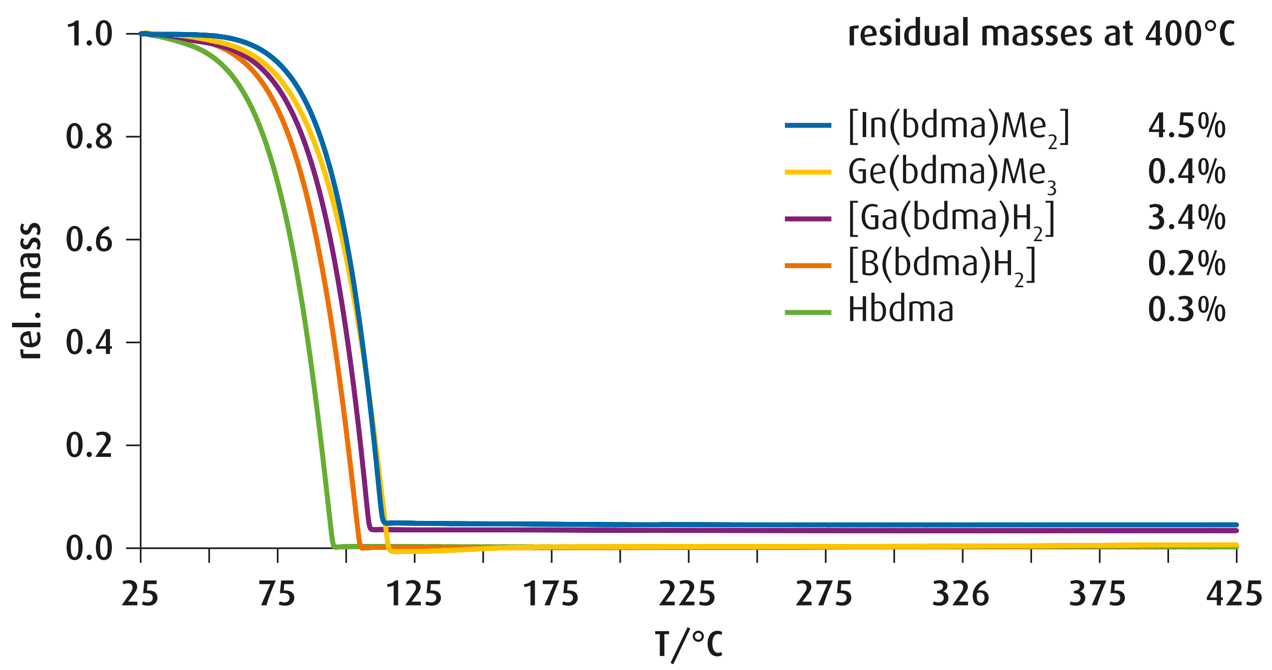
New Hydrazine Based Precursors For Semiconductor Fabrication

The progressive miniaturization in semiconductor devices calls for new CVD and ALD precursors to enable homogeneous and thin metal layers. Since oxygen or carbon are some of the critical sources of impurities, deposition experts are constantly seeking innovative chemistries that are free of carbon and oxygen to start with.

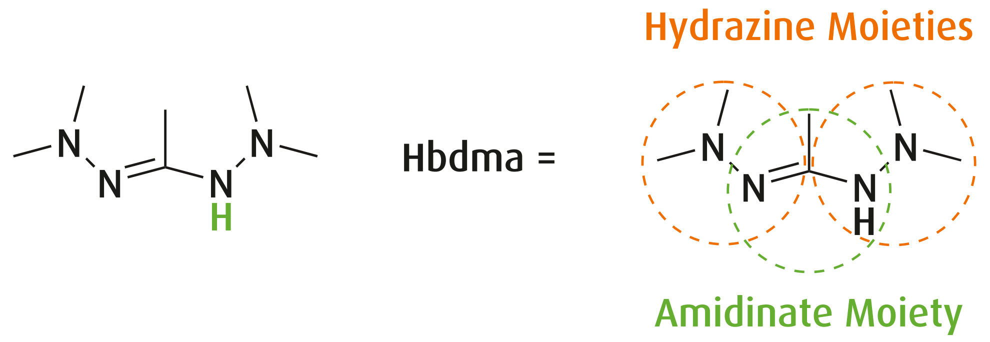
Herein we present a new class of precursors comprised of Hbdma ligand coordinated with Group III and IV elements as well as transition metals. The Hbdma ligand combines the advantages of the reactive gas of 1,1-dimethylhydrazine (often used in III/V semiconductor production) with the desired volatility of amidinates (a common ligand in ALD/CVD processes). The abundant presence of nitrogen coupled with the absence of oxygen conceivably leads to metal depositions virtually free of carbon and oxygen.

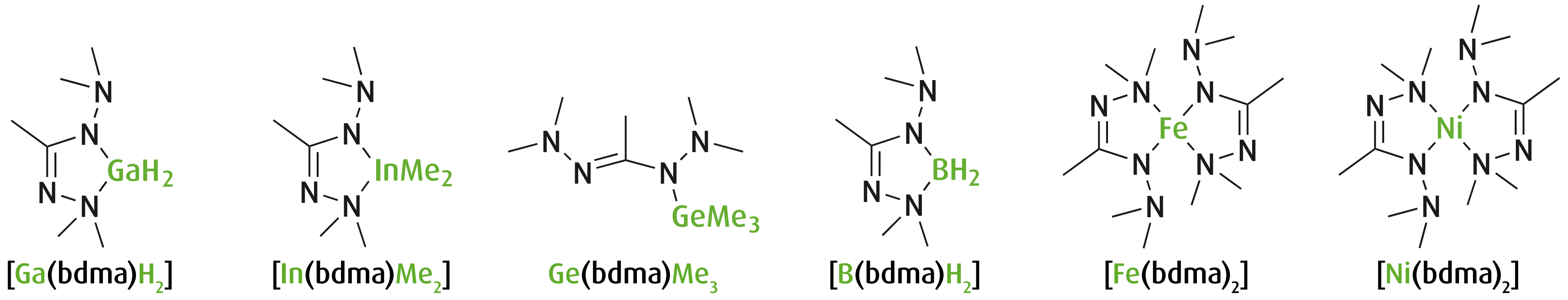
Complexes derived from Hbdma show remarkable feature of high thermal stability compared to the traditional precursors such as gallium hydrides and transition metal amides which are prone to thermal decomposition. For example, [Ga(bdma)H_2] is a distillable liquid at room temperature, transition metal complexes of [Fe$(bdma)_2$] and [Ni$(bdma)_2$] can be sublimed at slightly elevated temperatures. Initial deposition study shows that [Ga(bdma)H_2] could well be a single source precursor for GaN, and when used in conjunction with $^{t}BuAsH_2$, Ga(NAs) thin film is formed.

SCHEME 2: TGA curves of several bdma complexes and the neutral ligand Hbdma (heating rate = 10K/min)



SCHEME 1: relationship between Hbdma, hydrazine, and amidinate.





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