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ALD-based Catalysts with TiO_2 Interlayer for Ammonia Decomposition and LOHC Dehydrogenation Reactions

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In this work, we demonstrate the use of atomic layer deposition (ALD) to fabricate catalysts that can accelerate the production of green hydrogen through ammonia decomposition and liquid organic hydrogen carrier (LOHC) dehydrogenation reactions. The ALD-based catalysts were designed with tailored surface properties, including the deposition of a TiO_2 interlayer, to enhance the catalytic activity, selectivity, and stability for these reactions. We tested the catalysts in a series of experiments and observed a significant improvement in the reaction rate and lower activation energy for ammonia decomposition and LOHC dehydrogenation, compared to conventional wet chemistry-based catalysts. Our study demonstrated significant improvements in catalytic activity for both ammonia decomposition and LOHC dehydrogenation reactions. These improvements can be attributed to the efficient modification of the electron structure of metal nanoparticles, which was facilitated by the uniform TiO_2 interlayer introduced onto a 3D-shaped substrate using the ALD technique. Our results suggest that ALD with TiO_2 interlayer is a promising technique for developing efficient catalysts for green hydrogen production, which can help accelerate the transition to a sustainable energy future.