

Sustainable Innovations in CMP Slurries From Synthesis Methods to Environmental Impact

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As semiconductor technologies continue to advance in areas such as autonomous driving, artificial intelligence, 5G communications, the Internet of Things, and large-scale data processing, the demand for a reliable semiconductor industry is on the rise. This growing demand necessitates the use of advanced device architectures, which heavily rely on two crucial processes: Chemical Mechanical Planarization (CMP) and post-CMP cleaning.

This talk will focus on the development of CMP slurries and post-CMP cleaning solutions, emphasizing their vital roles in these processes. We will delve into the comprehensive development of CMP slurries and post-CMP cleaning solutions, highlighting how synthesis methods can significantly affect the surface chemistry of ceria abrasives and impact the removal rates of SiO₂ surfaces during STI CMP.

Our research also demonstrates how our cleaning solutions can effectively remove even the most 10 nm-sized ceria particles from SiO₂ surfaces, thereby enhancing process efficiency. Furthermore, we will discuss the use of aliphatic amino acids as environmentally friendly corrosion inhibitors in CMP slurries, offering a sustainable alternative to the traditionally used benzotriazole (BTA) and addressing key environmental challenges. In the context of the rapidly expanding semiconductor industry, it becomes critical to address global sustainability concerns and environmental health and safety (EHS) objectives. Our research proposes a comprehensive methodology for evaluating the sustainability of CMP consumables in semiconductor manufacturing, with a primary focus on CMP slurries due to their significant market share and shorter usage lifetimes. This research serves as a foundation for future CMP sustainability analyses, encouraging self-correction strategies within the CMP community to reduce environmental impact. We will also introduce a robust framework for the Life Cycle Assessment (LCA) of CMP consumables, marking a crucial step toward achieving these sustainability goals. In summary, this talk will explore the intricate details of CMP and post-CMP processes, their pivotal roles in the advancement of semiconductor manufacturing, and the imperative task of aligning these processes with environmental and sustainability objectives.