Specialized Foundry Services Drive Semiconductor Innovation

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Noel Technologies innovative lithography plating processes enables tall metal structures.

TRADITIONAL SEMICONDUCTOR structures involve depositing a metal film. A lithographic process then patterns the film which is then etched to create a structure. The metal film dictates the thickness of the structure. Most physical vapor deposition (PVD) films are limited to 2 µm through deposition. Some test, packaging, and assembly (backend applications), RDL and bump require taller metal features, often 5 µm to 50 µm of metal. Today, an innovative resist plating process from Noel Technologies uses a very thin metal, typically Cu, 1000Å PVD, called a seed layer, and very thick resist through the lithography process to achieve the desired tall metal structure (**FIGURE 1**).

For more than 30 years, this type of project is indicative of Noel Technologies approach to undertaking critical semiconductor process development projects for semiconductor equipment and device manufacturers. Often, these customers can't undertake the R&D project for one reason or another but yet it remains very important to the success of long-term research and development. In this respect, for many projects, Noel Technologies acts as an extension of the R&D team, providing a wealth of innovative lithography, thin-films and design and optimizations services that set it apart.

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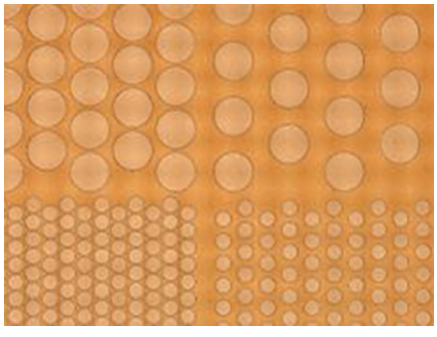
Noel through resist plating processes to enable thick metal structures

One such process is Noel Technologies' innovative, proprietary lithography plating process. In collaboration with Class One Technology, a leading supplier of wet processing tools for semiconductor process development, Noel Technologies combines 26 years of process development know-how with applications experience to help give life to many semiconductor, biotech and MEMS projects that would otherwise falter. Using its proprietary lithography process is one such example. Here, Noel Technologies allows the use of thin metal, 1000Å Cu, typically, thick plating resist between 5 µm to 50 µm, with 5:1 Aspect ratios and as small as 5 µm pitch. to achieve required thick metal structures. After lithography, the wafers are processed in ClassOne Technology's Solstice electrochemical deposition (ECD) chamber. Generally, the metal is plated to the height of the photoresist. Where the resist is covering the metal, there is no structure and in the areas that are open to the resist, the metal feature is plated. With subsequent photoresist strip and seed etch, the metal features can be isolated for device functionality. Developing lithography and plating these applications for thicker metal structures, using Noel's plating resist lithography process technology, opens up a plethora of application opportunities (**FIGURE 2**).

Noel's lithography process collaboration with ClassOne — Technology plating technology, creates a method to achieve substantially thicker or taller



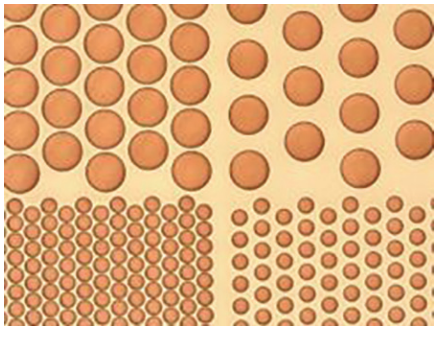


Figure 1a. Pre-plating 1000Å Cu Seed, 7 µm patterned photoresist. **Figure 1b.** Post plating 5 µm plated Cu.

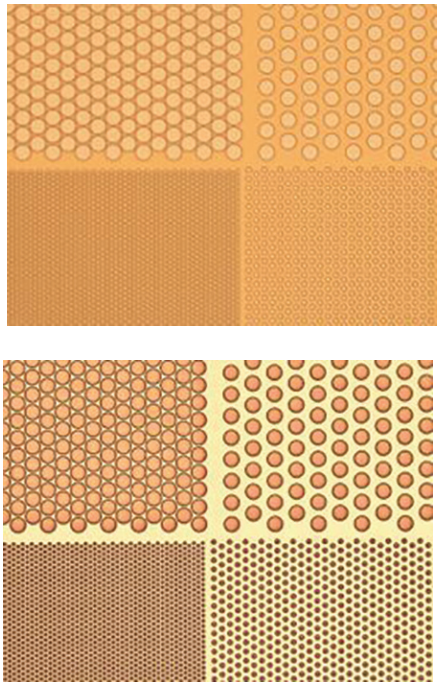


Figure 2a. Pre plating **Figure 2b.** Post plating

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metal structures where metal deposition and plasma etching of thick metal would be prohibitive (**FIGURE 3**). This process also allows for batch processing for high volume applications, versus single wafer plasma etching, therefore significantly reduces production costs.

Innovating for another 30 Years

Noel continues to innovate often serving as an extension of semiconductor and MEMS R&D groups. It is even branching out beyond semiconductors. For instance, its lithography process technology expands the opportunity for substantial increase per square inch when performing microfluidics sequencing for life science companies. Here, sub-micron features and structures can be created using thin films, etching, and expand data collection for a broad range of applications.

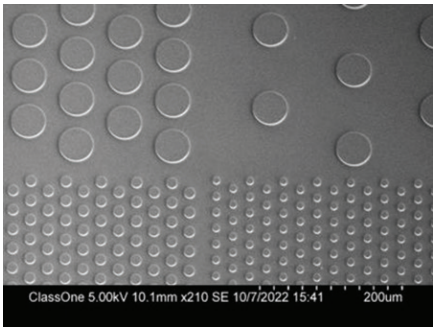

Figure 3. Post plating

Noel's semiconductor precision manufacturing techniques and processing provides hundreds of thousands of structures, creating simultaneous data points. Today, Noel provides development and production support to many semi, and bio start-ups in Silicon Valley and elsewhere as well-established companies, creating many, many, structures across silicon wafers. sd