

Low-Cost High-Volume Scale Up of CVD Graphene

Karlheinz Strobl, Mathieu Monville, Riju Singhal, **Samuel Wright**, and Leonard Rosenbaum

CVD Equipment Corporation, 355 S. Technology Drive, Central Islip, New York 11722, USA

Email: kstrobl@cvdequipment.com

CVD graphene can be manufactured on copper substrates using chemical vapour deposition (CVD) based processing. CVD graphene manufacturing process recipes are typically first developed and optimized on either atmospheric or low pressure R&D tube furnace systems. For these tools, the width and/or length of the CVD graphene growth substrate is traditionally limited by the diameter and heating length of a given process tube. Therefore, the general thinking is that only roll to roll CVD systems are able to mass produce CVD graphene.

Transferring an R&D CVD graphene growth process to a roll to roll CVD system can be time consuming, capital intensive, and potentially needs a lot of process redevelopment. Roll to roll CVD processing equipment is very customized, expensive to design and manufacture, and limits the available processing window. This can make the scaling up of CVD graphene production a risky effort, thereby holding back commercialization of CVD graphene enabled products.

We present test results of CVD graphene manufactured using a novel reactor design family¹ that allows for high quality, uniform deposition with a significant increase in CVD graphene substrate size as compared to the standard R&D CVD reactor setup. Process transfer and scale-up from R&D to production quantities is quick and straightforward. We demonstrate that our CVD reactors have the potential to outperform roll to roll systems in terms of throughput, while still retaining high quality material properties and characteristics. The cost per coated area is significantly reduced as compared to a roll to roll system. We will also demonstrate that this technology allows for the production of large rolls of graphene-coated flexible catalyst substrates that can be integrated into any roll to roll post-processing for various applications such as sensors, flexible transparent conductors, nanoporous membranes, photovoltaics, etc.

In summary, we present an accelerated, lower risk and lower cost route to the scale up manufacturing of CVD graphene on both sheets and rolls of copper foil, whether manufactured with low pressure or atmospheric pressure CVD systems.

References

¹Scalable 2D-FILM CVD Synthesis, patent pending