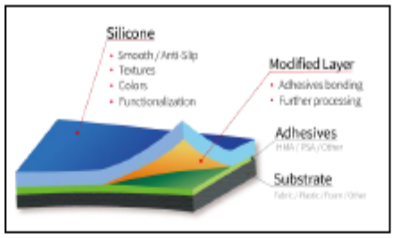
Topics and Abstracts:

Speaker	**Dr. Anupam Mukherjee**
Company	**General Silicones Co., Ltd.**
Designation	**Technical Director, R&D Center**
Title of Presentation	**Compo-SiL®, an Emerging Substrate for Flexible Hybrid Electronics and Electronic Skin**
Abstract	The demand for flexible, stretchable and wearable electronics has been growing up rapidly in recent years. In Flexible Hybrid Electronics (FHEs) with the significant development of flexible, stretchable and wearable electronic devices, elastic polymeric materials like PDMS (silicone rubber) [1] or a PU (polyurethane) [2] have become the most promising platforms for flexible, stretchable and wearable potential substrates [3]. Silicone is one of the materials of choice and widely recognized in large volume applications in industries like health care, electronics, automotive, aerospace, industrial assembly, building, textile, consumer etc. With having stronger Si-O bond (452 kj/mol) compared to C-O bond (358 kj/mol) and flexible siloxane backbone as well as diverse range of durometer scales and well recognized biocompatibility, it offers resistance to many environmental factors such as heat, temperature, electric, chemicals, UV/Ozone radiation and x-rays. Despite all these advantages, there was a long time key problem with cured silicone surface showing high inertness to bind with any other functional materials except using adhesive or plasma bonding [3]. We have successfully solved this key problem and are now able to produce a functional active layer on silicone as Compo-SiL® [4], so that, different functional materials like textile, TPU, PC, PET etc. can bind with the modified layer based on different functional applications. By combining and manifesting silicone technology, roll-to-roll manufacturing know-how, high production speed, surface technology, and polyurethane technology, we have successfully developed this breakthrough composite material which could act both as substrate & encapsulate at same time for flexible and also for stretchable printed electronics.

Compo-SiL® [http://www.compo-sil.com/] could act as transparent conductive layer, digitally printable by different conductive ink on Pu or TPU side with an encapsulation by silicone which could be washable, durable and bio-friendly as well as could be capacitive or resistive to detect the pressure and elongation. We have further applied this new substrate & material as stretching sensor [5], CVD Graphene / Metal based flexible capacitive pressure sensors [6], printing prototypes, electroluminescent film, transparent conductive layer, flexible heater etc.

In summary, with our revolutionary Compo-SiL® series product, electronic circuit could be embedded with any standard fabric allowing more functional, more comfortable with unprecedented freedom in wearable electronic design. Owing to its well-known biocompatibility, it could act as a flexible substrate directly attachable to skin. The revolutionary Compo-SiL® series product has opened up unlimited possibilities acting as an emerging material and substrate for Flexible Hybrid Electronics.



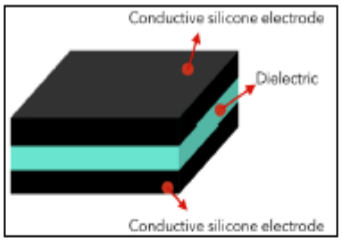


Figure 1(a): Schematic of *Compo-SiL®* (b) *Compo-SiL® E* Series

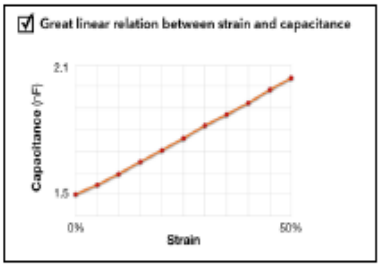


Figure 2(a): Measured relative capacitance change as a function of strain. (b) Roll to roll production (1400 mm upmost width)

[1] M. P. Wolf, G. B. Salieb-Beugelaara, P. Hunziker, progpolymsci. **83**, 97-134, (2018).
[2] W. Dang, V. Vinciguerra, L. Lorenzelli, R. Dahiya. Flex. Print. Electron. 2,013003, (2017).
[3] T. Someya, *Stretchable Electronics* (Wiley-VCH Verlag & Co. KGa 2013).
[4] A. Mukherjee, S. P. Yeh, Y. W. Chen, H. Y. Yang P085001-PCT-386, TW107118941, CN201810568629.4.
[5] S. P. Yeh, Y. W. Chen, H. Y. Yang, A. Mukherjee, P085002-CN-525.
[6] P. P. Pancham, A. Mukherjee, B. L. Yuan, P. Yu. ICFPE 2019, Submitted.

Biography

Dr. Mukherjee has a background of achievements in synthetic organic chemistry and material science for optoelectronic applications. Following Undergraduate, Masters Study and one year pharma based industrial experience in India; he obtained his PhD in NTHU in Taiwan in 2011 and then pursued a postdoctoral research in CYCU in Taiwan till 2014. Later he worked on development of innovative OLED materials and production for new product development in Lumtec till 2016.

Currently, in General Silicones as Technical Director of R&D Center, Mukherjee is engaged in corporate entrepreneurship to develop new ideas and opportunities within established business and carrying out investigations on design and development of various innovative large-scale manufacturing of high value added silicone products following multi-manufacturing processes (Roll to roll calendar, Extrusion, Injection and Compression molding). Under his leadership, a dynamic team oriented interdisciplinary group has developed an unique substrate & material, Compo-SiL® which has opened up great capabilities and diverse possibilities as emerging substrate for flexible or stretchable printed electronics with market segmentation in FHEs.