Peng Peng, an electrical and computer engineering alumnus of the Cullen College of Engineering at the University of Houston, is pioneering mass production of large-area graphene film based on groundbreaking research that started at his alma mater.

A special 2014 "Ten years in two dimensions" edition of Nature Nanotechnology journal featured articles about graphene capacitive touch panel technology and the world's first commercial graphene touchscreen smartphone, both developed by Peng in 2012 and 2013, respectively.

"As recognized by Konstantin Novoselov in his 2010 Nobel Lecture, the CVD graphene started with our UH paper published in the July 2008 issue of Applied Physics Letters,? said Steven Pei, UH electrical and computer engineering professor and deputy director of the Center for Advanced Materials. ?It was followed by the MIT paper published in 2008 and the Korean and UT-Austin papers published in 2009.

In 2007, Peng was part of a team led by Pei and fellow alumnus Qingkai Yu that synthesized graphene films on metal substrates by chemical vapor deposition (CVD) and transferred them to other substrates for the first time. The doctors' research opened the door for commercial application of CVD graphene films.
Based on the basic principles we established in Dr. Pei's group, we have continued to develop a new growth system and transfer technique in China with focus on industrial mass production and application, Peng said.

In 2011, Peng founded 2D Carbon Tech in China with the help of almost a dozen venture capital investors. The company scaled up single graphene film production to half a square meter and introduced the world's first graphene capacitive touch panel in 2012.

The next year, the company developed the first mass-production line with capacity for 30,000 square meters of graphene film per year. By the end of 2014, the company expanded production capacity to 150,000 square meters of graphene film per year and started a subsidiary company, 2D Optronics, to develop applications for the fourth-generation technology. The company grossed almost $1 million in sales last year.

Compared to the conventional, rigid transparent conductive material, indium tin oxide (ITO), used to manufacture touchscreen panels, flexible graphene film is less expensive, easier to fabricate and more environmentally friendly, Peng said.

Indium tin oxide is inflexible and fragile, and the raw material indium is an expensive rare metal that is not environmentally friendly, Peng said. Our goal is to partially replace indium tin oxide material in conventional touch panels and to dominate the transparent conductive material market in emerging flexible, wearable electronics.

Peng and his team continue to improve yield rates, to cut costs and to develop new applications for the technology. Graphene film has potential for applications such as biosensors, e-skins, thermal sink films and gas barrier materials.

Both industry and end consumers will benefit from this new material, Peng said. Within the next few years, we expect to see a lot of graphene industry products on the market.