Igniting the Fire for Circular Future

Dialogue

By LONG Yun & LU Zijian


Dr. Paulo Debiagi. (COURTESY PHOTO)

Imagine a world where the plastic choking our oceans is converted into jet fuel and steel mills operate on green hydrogen instead of coal. This is a quiet revolution happening in labs across China, led by innovators like Italo-Brazilian scientist Paulo Debiagi, whose work is redefining how we think about energy, waste and the very chemistry of civilization.

As Debiagi reminds us, "Since humankind discovered and mastered making fire, it has become a key process in civilization."

Today, that same fire, fueled by fossil resources, is causing climate change. The solution, he says, is not to extinguish the flame, but to "reinvent" it. His mission is to harness thermochemical conversion as a bridge to a circular future.

From theory to transformation

With a PhD in industrial chemistry and chemical engineering from the prestigious Politecnico di Milano, Debiagi studied energy and its transformational power and now, as an assistant professor at the China Beacons Institute, a part of research excellence of the University of Nottingham Ningbo China (UNNC), he leads research at the intersection of green chemistry, renewable energy, and waste valorization.

His focus is on development of sustainable thermochemical conversion processes where heat is used to break down materials into valuable products. Unlike burning, which fully converts materials into heat, these processes, such as pyrolysis and gasification, can be used to recover energy and chemicals sustainably. Nonetheless, where burning (combustion) is essential, we focus on making it cleaner by decreasing carbon intensity, facilitating carbon capture, and decreasing emission of pollutants.

"I chose to dedicate my career to developing sustainable materials and processes through thermochemical conversion, supporting the transition into the circular economy," Debiagi says. His vision is both pragmatic and profound: turning waste into worth, pollution into power.

One of the most urgent challenges is plastic pollution. Millions of tonnes of plastic end up in landfills or oceans. But Debiagi sees it as feedstock, not waste. His research explores thermochemical recycling of plastics via pyrolysis and gasification, breaking them down into syngas, oils, or even new plastics.

"The thermochemical recycling of waste plastics is a way to reduce plastic pollution and landfilling, creating fresh valuable plastic out of valueless materials," he explains. This isn't just recycling. It is about upcycling at the molecular level.

Similarly, non-recyclable municipal waste can be gasified to produce syngas, a clean-burning fuel that can replace natural gas. And agricultural residues, often burned openly, can be converted via biomass pyrolysis into bio-oil and biochar, offering cleaner skies, better soil, and renewable energy.

Global science with local benefits

With his mastery of computational chemistry, Debiagi builds digital models that simulate how molecules behave under extreme heat, predicting reaction pathways and optimizing conditions before any experiment begins.

This work has global reach. His models have been adopted by top institutions like the National Energy Technology Laboratory in the U.S. and Oxyflame Research Center in Germany, as well as leading Chinese universities like Tsinghua University and Harbin Institute of Technology.

"It is very exciting and rewarding when other colleagues and institutions implement the products of our research in their own," he says. "This is a clear sign that our research is relevant and unique, and is chosen by the community as a key to unlock their own scientific achievements." In the world of sustainable energy, where theory must meet engineering, such validation is invaluable.

Witnessing China's green leap

Why did an Italo-Brazilian scientist choose to build his career in China? "I see China as a leader in the world's sustainable transition," Debiagi answers. China, he observes, isn't just talking about green tech — it's deploying it at scale. The tight alignment between government, industry, and academia creates a powerful ecosystem for innovation.

His prior collaborations with Chinese peers revealed a culture of openness, investment in talent, and rapid implementation. "China was very open to mutual cooperation, paying lots of attention in talent development and workforce training," he says. A "blooming" scientific environment with abundant human resources, funding, and fast production adaptation.

For a researcher whose work depends on real-world impact, China offers a lab for transformation. Debiagi has witnessed China's green leap. In 2023, it accounted for three-fourths of global solar and two-thirds of global wind capacity. It's the world's largest battery maker and a leader in waste-to-energy systems.

"These aspects prove the commitment and the speed of China in investing in sustainable technologies, transforming the economy while respecting the environment," he says.

Powering a global transition

Another real challenge lies in heavy industries, such as steel, cement, and aviation where fossil fuels are deeply embedded. Here, Debiagi sees chemical energy carriers as the missing link: green hydrogen, ammonia, e-fuels, even metal fuels.

"Green H_2 can substitute natural gas in Direct Reduction of Iron (DRI) steelmaking," he gives an example. The breakthrough isn't in inventing new tech but in scaling and cost reduction. "The technologies required are already proven. It is a matter of reducing costs, boosting investments." And science's role in this is to refine efficiency and replace rare materials.

Looking ahead, Debiagi sees China as a global enabler. Through scale, policy, and exports, it can accelerate the energy transition worldwide.

"By reducing costs, exporting expertise, and participating in global governance, China will not only advance its own energy transition but also enable other nations to achieve their climate goals," he says.

At the UNNC, he aims to benefit from this flourishing environment, "As a researcher focused in green chemistry and energy, I aim to benefit from this flourishing environment, dedicating my expertise to give my best contribution to talent cultivation and technological development," he says.

Tech+Culture

Ancient Tibetan Art Meets Cutting-edge Tech

By Staff Reporters

Known as the "home of Tibetan painting," where art traditions like Thangka, crafting patchwork barbola and sculpting thrive, Huangnan Tibetan autonomous prefecture, Qinghai province, has seen these art forms, collectively known as Regong Art, recognized by UNESCO as an Intangible Cultural Heritage of Humanity.

Gengdeng is a provincial-level master of arts and crafts in Qinghai. He learned painting from elder artists as a child and has built a reputation in both Thangka and Tibetan architectural painting. "Compared to Thangka, architectural painting is less in demand and more challenging. Fewer artists are engaged in it," Gengdeng said. He has long dreamed of promoting and preserving this unique craft.

Upon learning of Gengdeng's efforts, Geng Shengling, a scholar at Qinghai Normal University's College of Computer Science, recognized the urgency of preserving Tibetan architectural paintings. "Digitalization, integrating technology with cultural protection, could offer a new way to revitalize this ancient craft," she said.

Joining forces, Gengdeng provides the artistic expertise, while Geng's team leads the digital preservation effort. Collaborating with universities and companies from Anhui and Jiangsu provinces, they launched a project focusing on digital preservation and shared use of Tibetan architectural paintings.

A resource database serves as the core of this digital preservation. The team used large-scale 3D laser scanning and digital photography to collect numerous architectural painting images from Qinghai and Gansu provinces. This allowed them to build a comprehensive resource database, forming an integrated knowledge base for Tibetan architectural painting art.

One challenging task involved digitizing a massive seven-meter-high, five-meter-wide mural on a wall of a famous Tibetan architectural complex in Huangnan. Time had caused cracks, fading, and even partial loss of the painting. Photographing it also presented challenges like tilting and reflection.

To overcome these challenges, the team developed innovative methods that enabled high-resolution, high-precision digital collection of source images, generating regularized painting patterns. Even missing parts could be extended and regenerated based on the original style and elements.

In mural painting, the outline sketch acts as the "skeleton" of the painting. With a shortage of such sketches in the database, the team employed deep learning methods to extract features and details from source images, producing high-quality outline drawings.

Tibetan architectural paintings often follow repetitive and symmetrical patterns. For example, in a "four-corner center" layout, the four corners use identical symmetrical patterns, while the center motif complements the overall style.

"By referencing common layout types, we hope to synthesize entire architectural paintings on computers, just like building with blocks," Geng explained.

During a demo, she created a new canvas in the system, selected elements like scroll patterns, floral motifs, geometric symbols and border decorations from the pattern library and dragged them into place. Using intelligent assembly technology and diffusion models, the system generated a complete architectural painting.

Using VR and 3D reconstruction technologies, the team also built detailed 3D models of several architectural complexes. "Put on VR glasses, and you can walk through virtual buildings. Many people have never seen exquisite Tibetan architectural paintings. VR offers an immersive, visually striking experience," Geng said.

Currently, her team is annotating the collected resources to form a high-quality database for AI models. They are also developing a more accurate vertical large model to generate architectural paintings using AI.


A painter creates a Tibetan Thangka painting, a national intangible cultural heritage, in Lhasa, Xizang autonomous region, August 6, 2025. (PHOTO: XINHUA)

Yunjin Brocade: Glowing Silk Craftsmanship

Traditional Eastern Wisdom

By BI Weizi

In the Chinese tradition of weaving Nanjing Yunjin brocade, two artisans work together to operate the upper and lower sections of a large, intricate loom, creating textiles from luxurious materials such as silk, gold and peacock feather thread. This method was previously used to make royal outfits such as dragon robes and crown costumes, and it is still used today to craft luxury clothing. In 2009, the technique was added to the UNESCO Representative List of the Intangible Cultural Heritage of Humanity.


A piece of Nanjing Yunjin brocade is on display in Beijing. (PHOTO: VCG)

The ancient Chinese named the brocade to reflect its exquisite essence: yun means clouds and jin means brocade. Like clouds in the sky, the material has an iridescent glow thanks to its distinctive weaving method and high-quality fibres.

The origins of Yunjin can be traced back to the late Eastern Jin dynasty (317—420), when General Liu Yu conquered the Later Qin kingdom and transported its artisans from Chang'an (now Xi'an, Shaanxi province) to Nanjing, which was the capital of China at that time. Most of these artisans were brocade craftsmen.

In 417, a government body overseeing the production of brocade was established in Nanjing, marking the start of Nanjing Yunjin brocade production. During the Yuan, Ming and Qing dynasties (1271—1911), brocade weaving methods reached their zenith.

The production of Nanjing Yunjin brocade involves over a hundred processes, including crafting looms, designing patterns, creating jacquard cards for programming weaving patterns, setting up the loom and various steps in the weaving process itself.

Working with the large wooden loom requires teamwork between two craftsmen: one stands at the top, manipulating the strings and directing the weaver regarding the design, while the weaver moves a shuttle up and down through the interchanging warps. The design motifs usually depict good fortune and blessings, such as dragons, clouds and peonies, and the weavers can alter the colours of the designs according to their preferences.

Due to the complexities of the weaving technique and the fragility of the raw materials, such as gold and silver-foil-covered threads, the weaving process cannot be fully automated. In an eight-hour day, two craftsmen can produce only 5—6 cm, which has led to the saying, "An inch of brocade equals an inch of gold."

As they "pass the warp and split the weft," the weavers chant mnemonic songs that recall the methods they use, thereby enriching the collaborative, creative environment at the loom, and ensuring the beauty of the textiles continues to be favored nationwide.

Service Info

China's New K Visa to Boost Exchanges

China has added a K visa to its ordinary visa categories, available to eligible young science and technology professionals, a Chinese foreign ministry spokesperson said on September 29.

This new type of visa aims to facilitate exchanges and cooperation between Chinese and international young professionals in scientific and technological fields, spokesperson Guo Jiakun told a regular news briefing when answering a related question.

According to relevant reports, the new rules have taken effect on October 1. In comparison to the existing 12 ordinary visa types, K visas will provide added convenience for holders, including more permitted entries, longer validity periods, and extended durations of stay. After entering China, K visa holders can engage in exchanges in fields such as education, culture, and science and technology, as well as relevant entrepreneurial and business activities.

Bar specific age, educational background and work experience requirements, applications for K visas do not require a domestic employer or entity to issue an invitation, and the application process will also be more streamlined.

Source: XINHUA

Youth Innovation: Governance & Responsibility

Expats Activity

By Staff Reporters

At the recent Global Youth Innovation Talk themed "Global Governance and Youth Responsibility" in Beijing, international representatives discussed youth participation in governance, AI innovation in social governance, and international dialogue and cooperation through mini-TED talks, guest salons and interactive sessions. They also explored new ways for AI technology to contribute to global governance.

At the mini-TED session, Nil Larom, founder of Insaight in France, and Gustavo Cadiz, founder of Startup Go Academy in Bolivia, discussed the key trends in technological development and entrepreneurship education. Larom said, "AI should not merely be a business tool, but an enabler that drives global development, social progress, and improves the quality of life."

At the guest salon session, Devinder Kumar from the China Foreign Languages Publishing Administration's Central and Eastern Europe and South Asia Communication Center presented the "Red Line Theory," arguing that humanity must grasp the dominant role of AI in key areas such as justice and peace.

He called on young people to promote transparent AI systems and participate in global rule-making. They should also learn professional techniques and ethical standards. Through exchanging views and building consensus, the representatives agreed that they should participate actively in global governance processes, using their innovative thinking to contribute to international exchange and cooperation.