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Nanoscale Horizons Emerging Investigator Series: Dr Siqi Li, Anhui University, China

Our Emerging Investigator Series features exceptional work by early-career nanoscience and nanotechnology researchers. Read Siqi Li's Emerging Investigator Series article 'Destruction for growth: a novel laser direct writing perovskite strategy with intelligent anti-counterfeiting applications' (**https://doi.org/10.1039/D4NH00612G**) and read more about him in the interview below.

Dr Siqi Li completed his bachelor's degree in 2013 and master's degree in 2016 at Central South University. In 2020, he earned his PhD from The Hong Kong Polytechnic University. Between 2020 and 2021, he worked as a postdoctoral researcher at City University of Hong Kong. He is currently an associate professor at Anhui University. His research focuses on synthesizing and characterizing novel perovskite materials and metal–organic frameworks, utilizing advanced fabrication techniques (femtosecond processing, inkjet printing and photolithography) to fabricate micro/nano-optoelectronic devices. These devices are targeted for applications including micro/nano-lasers, radiation detection, and optical communication.

Read Siqi Li's Emerging Investigator Series article 'Destruction for growth: a novel laser direct writing perovskite strategy with intelligent anti-counterfeiting applications' (https://doi.org/10.1039/D4NH00612G) and read more about him in the interview below:

NH: Your recent Nanoscale Horizons Communication describes a novel laser direct writing perovskite strategy with intelligent anti-counterfeiting applications. How has your research evolved from your first article to this most recent article and where do you see your research going in future?

SL: My PhD research focused on femtosecond laser-pumped perovskite semiconductor lasers, exploring their lasing properties under multiphoton excitation. At Anhui University, I expanded my work to fabricating perovskite composite glass-based laser devices and exploring femtosecond laser direct writing of perovskites. This evolving technology allows for the direct fabrication of 2D, quasi-2D, and 3D perovskite crystalline structures on various substrates.

In our investigations of perovskite/phosphate glass composites, we observed that rapid annealing introduces residual stress into the glass matrix, resulting in surface cracking (ranging from cross-section to fine micro-cracks), followed by the gradual precipitation of perovskite nanocrystals on these fractured surfaces. This ''damage-induced'' crystal growth phenomenon sparked our interest in developing precise stress control methodologies. Consequently, we employed femtosecond laser processing of perovskite phosphate glasses, combined with thermodynamic and kinetic modeling, to systematically elucidate this observation.

In the future, my research will remain centered on the application of femtosecond laser direct writing of perovskites. The remarkable compositional diversity of the perovskite family—encompassing lead-based and lead-free variants with tunable halogen content—provides a highly versatile platform for tailoring their intrinsic properties. This is expertly complemented by femtosecond laser processing, where pulse parameters like width, repetition rate, and peak intensity critically dictate the crystalline structure and composition of perovskites. This precise interplay between material tunability and laser capabilities is essential for advancing perovskite applications. We also further explore the integration of femtosecond-fabricated perovskite devices into areas such as photonic circuits, advanced anti-counterfeiting, and high-resolution 3D displays.

NH: How do you feel about Nanoscale Horizons as a place to publish research on this topic?

SL: As a prestigious journal of the Royal Society of Chemistry (RSC), *Nanoscale Horizons* enjoys an exceptional

reputation and extensive influence in the field of nanoscience and nanotechnology. We greatly appreciate the journal's efficient and prompt processing of our manuscript under its high-standard academic review. The professional and constructive comments provided by the reviewers have played a crucial role in enhancing the quality of our article. We are extremely honored to have our work published in *Nanoscale Horizons*.

NH: What aspect of your work are you most excited about at the moment?

SL: For me, the greatest excitement in my work lies in the freedom to design research topics and experiments according to my interests. This freedom allows me to independently explore unknown areas and translate scientific ideas from my mind into viable experimental plans, such as synthesizing a novel material system or validating a hypothesis.

NH: In your opinion, what are the most important questions to be asked/answered in this field of research?

SL: Femtosecond laser direct writing offers significant potential for perovskite device fabrication. The primary challenge for its widespread application is achieving high processing speed and efficiency while maintaining fabrication precision. Addressing this challenge requires not just advancements in laser systems or parallel writing techniques, but more crucially, a profound comprehension of the intricate interplay between femtosecond lasers and perovskite materials. Mastering these mechanisms will enable us to select optimal perovskite systems and process parameters, paving the way for transitioning from lab-scale prototyping to cost-effective, industrial-scale production and ultimately enabling broad application in optoelectronics.

NH: What do you find most challenging about your research?

SL: I think the greatest challenge lies in how to systematize my research—specifically, ensuring the alignment of long-term strategic goals with short-term plans, sustaining research progression, and ensuring its effectiveness and efficiency

NH: In which upcoming conferences or events may our readers meet you?

SL: I plan to attend some semiconductor and perovskite device conferences, such as the ''Young Scholars Forum on Perovskite Materials and Devices''. I will share experiences in perovskite processing with other researchers.

NH: How do you spend your spare time?

SL: During my free time, I enjoy spending time with my family. We might do some light physical exercise or go on short outdoor excursions on weekends. These moments with them help me feel relaxed.

NH: Can you share one piece of career-related advice or wisdom with other early career scientists?

SL: As a new independent researcher, I'm still learning and exploring, but I think staying on the laboratory frontline is key. It lets me guide students more directly with their experiments, and also helps me quickly grasp and analyse results. Some of my work, including this paper, originated from unexpected experimental observations.