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Syracuse University Scientists Develop Ultra-Thin Absorbers with Record-Breaking Bandwidth

SYRACUSE, NY, UNITED STATES, January 27, 2025 /EINPresswire.com/ -- Absorbing layers have been fundamental to advancements in technologies like energy harvesting, stealth systems, and communication networks. These absorbers efficiently capture electromagnetic waves across broad frequency ranges, enabling the development of sustainable, self-powered devices such as remote sensors and internet of things (IoT) systems. In addition to energy applications, these layers are pivotal in stealth technology, where they minimize radar visibility and enhance the performance of aircraft and naval systems. They also play a crucial role in improving communication networks by reducing stray signals and mitigating electromagnetic interference, making them essential in our increasingly interconnected world.

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> *Professor Younes Ra’di*

Advancements in these technologies requires modules with greater functionality and broader bandwidths, all within smaller footprints, driving the demand for ultra-thin absorbing layers with significantly higher absorption bandwidths. However, a theoretical upper bound exists on the bandwidth-to-thickness ratio of metal-backed, passive, linear, and time-invariant absorbing layers. Absorbers developed to date, irrespective of their operational frequency range or material thickness, significantly underperform when compared to this upper bound, failing to exploit the full potential that passive, linear, and time-invariant systems can provide.

In a new research paper published in Nature Communications, Syracuse University Electrical Engineering and Computer Science Professor Younes Ra’di and his research team introduced a new concept for designing ultra-thin absorbers that enables absorbing layers with a record-high bandwidth-to-thickness ratio, potentially several times greater than that of absorbers designed using conventional approaches. Absorbers designed based on this concept can achieve a bandwidth-to-thickness ratio arbitrarily close to the ultimate bound. Utilizing this concept, they designed and experimentally verified an absorber yielding a very high bandwidth-to-thickness ratio.

“Our findings have the potential to make significant contributions to various industries, including defense, energy harvesting, and advanced communication systems, by addressing critical challenges in electromagnetic absorption technology,” says Ra’di.

“It’s incredibly rewarding to see our work attracting international recognition, not only from the scientific community but also from key players across various industries. I am immensely proud of my team for their dedication and hard work, which have led to these groundbreaking results. Publishing in a prestigious journal like Nature Communications is a testament to their exceptional efforts and the importance of our research.”

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