The LEC—now an efficient and bright device

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The light device LEC is flexible and thin. Credit: Umeå University

Researchers from Umeå University and Linköping University in Sweden have developed light-emitting electrochemical cells (LECs) that emit strong light at high efficiency. As such, the thin, flexible and lightweight LEC promises future and improved applications within home diagnostics, signage, illumination and healthcare. The results are published in *Nature Communications*.

The light-emitting electrochemical cell (LEC) can be thin, flexible, and light-weight and be driven to essentially any emission color by the low voltage of a battery. It can also be extremely low cost, since it can be fabricated with low-cost printing and coating methods similar to how newspapers are fabricated.

A persistent problem is that it has not been possible to attain strong brightness at high efficiency from LEC devices. In fact, it has been questioned whether the LEC is even capable of being simultaneously bright and efficient. In the current issue of *Nature Communications*, a team of scientists demonstrate a path toward resolving this problem. Using a systematic combination of experiments and simulations, they have established a generic set of design principles, including balanced trap depths, optimized doping, and electrochemically stabile materials. The approach has paved the way for LEC devices that emit light with a high brightness of 2,000 cd/m^2 at an electron-to-photon efficiency of 27.5 percent.

"As a point of reference, a normal TV operates between 300 to 500 cd/m^2, while 2,000 cd/m^2 is the typical brightness of an OLED illumination panel. Concerning efficiency, our LEC device is close to that of common fluorescent tubes," says Ludvig Edman, leader of the project and professor at the department of physics at Umeå University.

"With this performance, the LEC component is now not only offering low costs and highly attractive design advantages, but is also becoming a

true competitor with existing technologies, such as the fluorescent tube, LED and OLED, as regards to efficient and practical operation," says Martijn Kemerink, professor at the department of physics, chemistry and biology at Linköping University.

More information: Shi Tang et al, Design rules for light-emitting electrochemical cells delivering bright luminance at 27.5 percent external quantum efficiency, *Nature Communications* (2017). DOI: 10.1038/s41467-017-01339-0

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