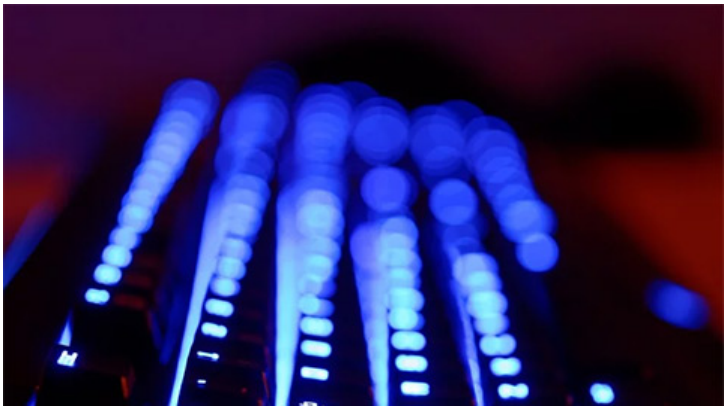
“The Red Sun”: scientists propose a luminophore for high-quality imitation of sunlight

A research team of experts from China, Russia, the United States, and Taiwan created a luminophore based on europium oxide, excited by blue light and emitting red light. These luminophores are supposed to help to improve and cut the cost of the technology for WLED production — white LEDs which emit in daylight spectrum that is optimal for the human eye (WLED).



As a rule, white LEDs contain a diode that emits blue light when electricity runs through it. A paste-like yellow luminophore absorbing blue light and emitting yellow glow is applied to this diode. Some part of blue light is absorbed by the luminophore powder and converted to yellow, while the remaining part of blue light passes freely. Yellow and blue gushes together give white light. This is the so-called YB-strategy (Yellow + Blue). The colour rendering index (CRI) of this compound, however, is very low (CRI <75), while the perfect white colour has 100.

‘You can increase colour rendition by mixing green, red and blue (RGB-strategy), or simply add red to YB-LEDs, since it is exactly what we lack to increase the colour rendering index. The substances that emit red are well known, but they are difficult to manufacture and expensive since they are mainly nitrides, but not oxides. Oxides, in turn, are widespread and cheap, but it is difficult to find an oxide that could emit red light when doped with europium oxide (Eu2+) and especially when illuminated with blue light. But we remember that the diode produces blue light, and we need to use this exactly diode for conversion into red light. Our group has just found the right material that is fundamentally important for producing white LEDs,' explained **Maxim Molokeev**, an associate professor at the Department of Solid State Physics and Nanotechnology at SibFU, a senior researcher at L.V. Kirensky Institute of Physics, Krasnoyarsk Research Centre of SB RAS.

The researcher specified that the detected compound has high thermal stability as even the strongest heating (sometimes the temperature reaches 150 °C when the LED lamp is on) does not significantly reduce the intensity of the emitted red light. As white is obtained by mixing two or three colours, this weakening of one of them due to overheating will turn the usual white glow into pink or yellow. Now imagine, for example, reading by a lamp that shows such strange metamorphoses.

‘The colour rendering index (CRI or Ra) of the compound we studied is 93 which is close to 100, it means that the light is almost white. As for the correlated colour temperature, if a black body is heated to 4013 K, it will emit white light which will approximate the light of the lamp that we have produced. The sun (also a completely black body) has a surface temperature of ~5700 K, and our eye considers such radiation to be the most comfortable. The eye sensitivity maximum, by the way, almost coincides with the maximum of the spectrum of the Sun. This adjustment occurred evolutionarily. Nocturnal animals or insects have a completely different spectral distribution. But we produce lamps for people, not for animals or insects, that is why it is important for us to provide comfort specifically for the human eyes, and this is the radiation of the Sun. So, by mixing the spectra of different substances,

researchers are trying to reproduce a spectrum similar to the solar. And of course, it is important that these substances would be steady, thermally stable and inexpensive. And so that "doping" of luminophores would occur with the help of cheap blue LEDs,' highlighted **Maxim Molokeev**.

Currently, the surveys aimed at finding luminophores that will improve LEDs for perfect white light are ongoing. The information on this can be found here and here.

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