In recent years, the consumer lighting market has had a rapidly increasing offering of LED base light bulbs to replace the traditional incandescent light bulbs. The challenge for a replacement market is to have the light colour which the consumer expects, a form factor which is comparable to the traditional incandescent light bulbs and a thermal solution which is orientation independent whilst aesthetically fulfilling customer desires.

Traditionally, to decrease the LED temperature, one would have to increase the size of the heat sink. But how low can you go without increasing the size of the light bulb heat sink?

With one of the design constraints being the form factor of a traditional light bulb, Lemnis Lighting B.V. asked its partner ATS Europe, B.V. to design a thermal management solution that can have the lowest possible heat sink temperature. To do this with simulation, one needs to have a simulation tool which can accurately predict the thermal performance of a complex natural convection phenomenon of extremely curved 3D solid objects.

How Difficult Can LED Lighting Be?

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How Small Can You Go?

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6SigmaET allows for the rapid thermal evaluation of different designs... this is critical to the short term and long term success of our LED product.

Norbert Engelberts
Director, ATS Europe
Optimal Thermal Solutions BV
The Results

Experimental testing of the initial design showed that there was a maximum of just 5% difference between 6SigmaET’s predicted temperatures and the actual experimental values. Similarly for the new design, 6SigmaET’s predicted temperatures were within 5% of the experimental temperatures.

The use of 6SigmaET to test and evaluate the light bulb designs reduced the requirement for physical prototypes, allowed the accurate assessment of the performance, suitability and effectiveness of each design modification, and therefore aided the development of the new and improved light bulb design significantly. At the end of the process, it was found that there was a 14% improvement in the light bulb’s performance overall, as a result of the changes to its design.