is transmitance $T$, absorbance $A$, and reflectance $R$. Transmission coefficients are determined from reflection and Kirchoff's Law for Thermal Equilibrium.

Layered Structures simplify manufacturing. Economical compared to Light-Emitting Diodes (LEDs). Low environmental impact unlike fluorescent bulbs. High melting point (over 2800 K). Peak emittance over most angles from filament surface (390-700 nanometers (nm)). Peak emittance over the visible spectrum.

**Ideal Improved Filament**

- Peak emittance over the visible spectrum (390-700 nm)
- Peak emittance over most angles from filament surface
- High melting point (over 2800 K)
- Low environmental impact unlike fluorescent bulbs
- Economical compared to Light-Emitting Diodes (LED's)
- Layered Structures: simplifies manufacturing

*Figure 1: Tungsten/Silicon Carbide Filament Structure*

**Emittance Calculations**

Kirchoff's Law for Thermal Equilibrium:

$E = A = 1 - R - T$

- Emittance determined from reflection and transmission coefficients
- $E$ is emittance, $A$ is absorbance, $R$ is reflectance, and $T$ is transmittance

The Transfer-Matrix Method:

$M = \begin{bmatrix} M_{11} & M_{12} \\ M_{21} & M_{22} \end{bmatrix}$; $R = \frac{1}{M_{11}}$; $T = \frac{M_{21}}{M_{11}}$

- Elements of the transfer matrix ($M$) help calculate $R$ and $T$
- Transfer matrix found by multiplication of propagation and boundary matrices

**Results and Conclusions**

**Resulting Structure**

- 3-layered tungsten and silicon carbide structure
- 92% emittance over the visible range
- Peak emittance from 400 to 650 nanometers and 0 to 70 degrees
- 1-800 nanometer layer widths

**Conclusions**

- Structure can operate at 2900 K
- Tungsten melting point: 3400 K
- Silicon Carbide melting point: 3000 K
- Emission doubled in the visible spectrum compared to traditional filaments

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