

Thermal Properties of SK One Component Polyurethane using Experiments and Multiphysics Simulations

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Abstract

This study proposes to determine the thermal conductivity of SK One Component Polyurethane (SKOCP) developed by China Institute of Water Resources & Hydropower Research Beijing IWHR-KHL Co. Ltd. SKOCP provides excellent proof of aging and chemical resistance of this material. It is non-toxic, acts as a good anti-seepage, offers anti-abrasion and good anti-freezing performance. In addition, it has high strength, high elongation and good bonding with base materials (i.e. concrete, metal surfaces, etc.). With all these robust properties, the one component polyurethane seems the most favourable material for construction in cold regions as it acts as anti-freezing and protects against freeze-thaw fractures.

The research aims to study SKOCP in depth and to determine its thermal conductivity using experimentations and multiphysics based numerical simulations. The standard experimental setup, as suggested by Kvadsheim, Folkow et al. (1994), will be used to determine the thermal conductivity. In addition, infrared imaging technique will also be employed to study the thermal profiles, which will be used to estimate the thermal conductivity (Rashid, Khawaja et al. 2016). The thermal data will be compared against the multiphysics numerical simulation results. The study will help in building the confidence between the experimentation and multiphysics based numerical studies and provide scientific background for application of SKOCP in the Cold Climate.

Fourier's Law of Thermal Conduction

$$\dot{q} = k \frac{\partial T}{\partial x}$$

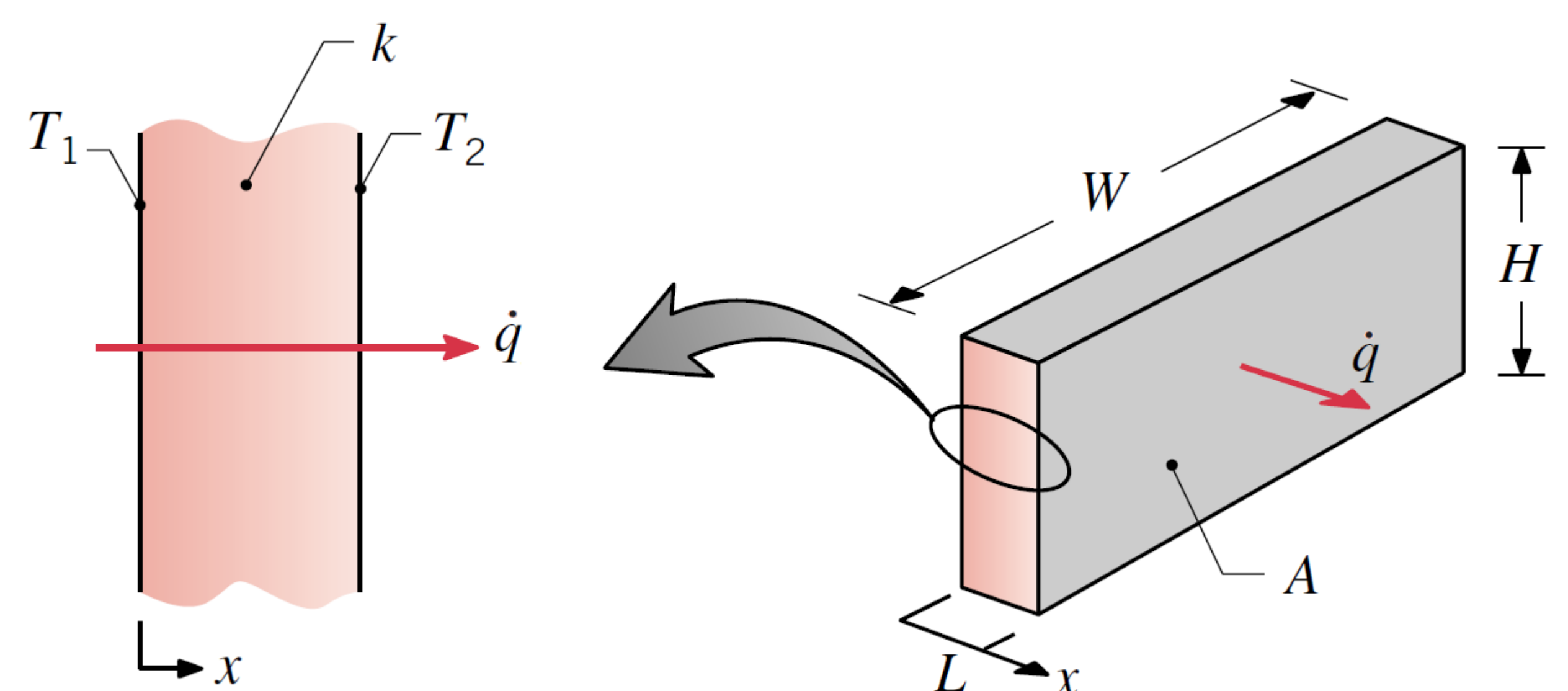
where \dot{q} is heat flux in $\left(\frac{W}{m^2}\right)$,

k is thermal conductivity of material $\left(\frac{W}{m.K}\right)$,

T is temperature (K), and

x refers to spatial position (m).

Unidirectional Thermal Conduction



Properties of SK One Component Polyurethane

- Good aging resistance
- Non-toxic
- Good anti-seepage and anti-abrasion performance
- High strength, high elongation and good bonding with base concrete
- Good chemical resistance
- Good anti-freezing performance
- Simple and convenient construction

FLIR® 1030SC IR Camera

- 1024 x 768 pixels
- Up to 480 Hz capture rate
- Sensitivity < 20 mK
- -40 °C to 2000 °C Range
- Portable
- Multiple Lens Options
- Interfacing options



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