

## Thermal Conductivity and Thermal Radiation Properties of $\text{UO}_2$ <sup>1</sup>

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### Abstract

More than 300 publications have been revised for studying the thermal conductivity and the thermal radiation properties of  $\text{UO}_2$ .

The temperature, the porosity, the uranium to oxygen ratio and irradiation effects have an important influence on the thermal conductivity. The thermal conductivity of stoichiometric  $\text{UO}_2$  with nearly theoretical density is well known up to the melting point with a maximum uncertainty of  $\pm 15\%$ . Relations can be established to calculate the conductivity of porous  $\text{UO}_2$ .

The correlation between the conductivity and the O/U ratio could not be described analytically but the qualitative dependence is evident.

Only a few publications could be found on thermal radiation properties of  $\text{UO}_2$ ; most of them are investigating the radiation transport through solid fuel. Emittance data are therefore quite speculative. The total emittance and the spectral emittance might be approximately 0.9, and not significantly dependent on temperature and porosity or surface roughness.

### 1. Introduction

During the last 15 years a great number of investigations concerning thermal conductivity of  $\text{UO}_2$  has been published. The most important problem is, that this material appears in various forms concerning its chemical and structural properties. Variations in temperature, porosity, impurities and uranium to oxygen ratio as well as irradiation effects and the use of different measurement methods implies a wide scatter of measured thermal conductivity values. A critical review of the published measurement results seems to be of interest, since the dependence of the thermal conductivity on those parameters can be established by summarizing the numerous investigations under considerations of theoretical correlations.

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<sup>1</sup> Dedicated to Prof. Dr. K. H. Höcker, Stuttgart, on occasion of his 60th birthday.