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Dissipative processes in porous solids filled by a fluid flow

LILIANA RESTUCCIA [a] *, LIDIA PALESE [b], MARIA TERESA CACCAMO [a] AND ALESSIO FAMÀ [a]

ABSTRACT. In a previous paper, in the framework of extended irreversible thermodynamics with internal variables, a model for nanostructures with thin porous channels filled by a fluid flow was developed. The porous defects of porous channels inside the structure, described by a permeability structure tensor, may have a strong influence on the effective thermal conductivity, and their own dynamics may couple in relevant way to the heat flux dynamics. Here, in the linear case a generalized telegraph heat equation for thermal perturbations with finite velocity is derived in the anisotropic and isotropic case for the nanosystems taken into account. The thermal disturbances are so fast that their frequency becomes of the order of reciprocal of the relaxation time, given, for instance, by the collision time of heat carriers. Furthermore, the complete system of equations describing the behaviour of the media under consideration is worked out and discussed. The obtained results have applications in "defect engineering" and an important technological interest.

[a] Università degli Studi di Messina Dipartimento di Scienze Matematiche e Informatiche, Scienze Fisiche e Scienze della Terra Contrada Papardo, 98166 Messina, Italy

[b] Università degli Studi di Bari Dipartimento di Matematica Via E. Orabona, 4, 70125, Bari, Italy

* To whom correspondence should be addressed | email: van.peter@wigner.mta.hu