Mixtures of Chemically Reacting Fluids and Diffusion Processes on Semipermeable Interfaces

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We investigate a mixture of chemically reacting fluids in a semipermeable interface. This interface has thermodynamic and mechanical properties. The surface of this interface has an arbitrary shape and we assume a closed shape and that this shape is dependent on time. This interface is to be seen as membrane which is influenced by an external force field and radiation field. We give a generalisation of the balance equations [1] and we give a systematic investigation for the constitutive equations. We discuss the transformation properties in space and on surfaces of the constitutive equations for a membrane. From the representation theorem we obtain isotropic representations for the constitutive equations. If we introduce these constitutive equations into the balance equations then we shall obtain field equations for the thermodynamic surface fields. Each solution of the field equations on the surface is called a thermodynamic process on the surface. Our main object is concentrated only to such thermodynamic processes which do not violate the entropy principle on interfaces. Consequences from this requirement are thermodynamic surface relations and restrictions for the constitutive equations on the interface as well as for the constitutive relations of the bulk quantities on the surface. Using integrability conditions for the surface entropy relation, we reduce the list of variables in some surface quantities. Furthermore, we derive from the field equations of the moment Ficks diffusion law on semipermeable interfaces.

1. Grauel, A. (1980) Physica A.