In this article we have given the results of an investigation into the effects of porosity, pore size, and temperature upon the kinetic parameters of the process of infiltration of porous titanium by magnesium and its alloys. The kinetics and optimum processing parameters of infiltration of porous titanium compacts by magnesium alloys were studied with the aim of developing a suitable technique for the manufacture of new composite materials—titanium-magnesium pseudoalloys [1-5].

According to available literature data [6, 7], the components of the titanium-magnesium system are virtually insoluble in each other. The angles of contact of liquid magnesium on titanium, determined by the sessile drop method, in a vacuum corresponding to (3-5) \times 10^{-5} \text{ mm Hg} and in a thoroughly dried argon atmosphere at temperatures ranging from 700 to 850°C are close to zero irrespective of the grade of magnesium alloy used, environment, and temperature. The high degree of wetting in the system at the very low inter-solubility of its components is in all probability attributable to the destruction of interlayers between the phases, as a result of which good metallic contact is made between them; and, as is shown in [8], the reaction between a solid and a liquid metal in a contact layer is sufficient, even in a nonreactive system, for the attainment of a high degree of wetting.

To study the kinetics of the infiltration process, specimens (of 10-mm diameter and 100-mm length) with porosities of 80, 40, and 25% were prepared from PTS reduced titanium powder and PTÉM-2 and PTÉS-1 electrolytic powders. As infiltrating materials ML-5 and IMV-3 magnesium alloys were used. The high-porosity specimens were obtained from loosely poured powder by vacuum-sintering in quartz tubes. Specimens with porosities of 40 and 25% were produced by hydrostatic pressing and sintering. Transverse and longitudinal variations in porosity (determined by weighing and measuring specimens) amounted to 2-3% for the specimens with porosities of 25 and 40%, while for the specimens with a porosity of 80% they did not exceed the limits of experimental error (±1%). The porosities and pore sizes (determined in [9]) of specimens prepared from the different titanium powders are given in Table 1.

Specimens from each grade of titanium powder were sintered under the same conditions in order to ensure a virtually identical grain size, while different porosities were obtained by varying pressing conditions.
It was these specimens, characterized by very similar grain sizes and the same pore shape, that enabled the effect of porosity on infiltration kinetics to be determined.

To examine the effect of pore shape on the kinetic parameters of the process, a comparison was made of the rates of infiltration of PTS and PTÉM-2 powder specimens of the same porosity (40%) and practically identical pore shapes. Specimens of 40% porosity from PTÉM-2 and PTÉS-1 electrolytic powders, which had