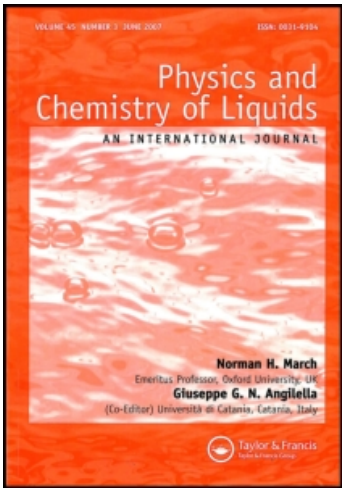

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STUDY ON THE SOLIDIFICATION PROCESS OF HgTl AMALGAM AT 30 at.% Tl

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By means of a toroidal oscillating viscometer, logarithmic decrements of dampings have been measured in presence or absence of HgTl amalgam at 30 atomic percent thallium, at different temperatures, ranging from 12°C to 23°C.

Keywords: Phase diagram; viscometer damping

INTRODUCTION

In previous papers [1, 2] the HgTl amalgam was investigated at various atomic percentages. In paper [3] studies on the solidification process of HgTl amalgam at 28.2 at.% Tl were performed. In paper [4] evaluation of viscosity of the melting point of HgTl amalgam at 30 at.% Tl suggested experiments on the solidification process.

In the present study we focused on the logarithmic decrements of a viscometer dampings in the presence or absence of this amalgam, at different temperatures, from 12°C to 23°C.

EXPERIMENTAL APPARATUS

The toroidal oscillating viscometer used in the present investigation was the same as previously employed [1, 2].

EXPERIMENTAL RESULTS

The viscometer dampings in presence or absence (δ and δ_0, respectively) of the HgTl amalgam at 30 at.% Tl have been measured at different temperatures, ranging from 12°C to 23°C. For the dampings obtained in the temperature range from 12°C to 23°C the viscosity η has been calculated using formula (1), as reported in Refs. [1, 2].

$$\frac{I\sqrt{2}}{4\pi^3 a^2 R^3 \rho}\left[(1+T^2/T_0^2)\delta - 2T\delta_0/T_0\right] = g_1(q) - \delta g_2(q) + a^2 g_3/R^2(q) \tag{1}$$

The experimental results are presented in Ref. [4].

DISCUSSION OF EXPERIMENTAL RESULTS

The solidification process of HgTl amalgam at 30 at.% Tl occurs gradually, as the temperature-dependent δ variations shown in Figure 1.

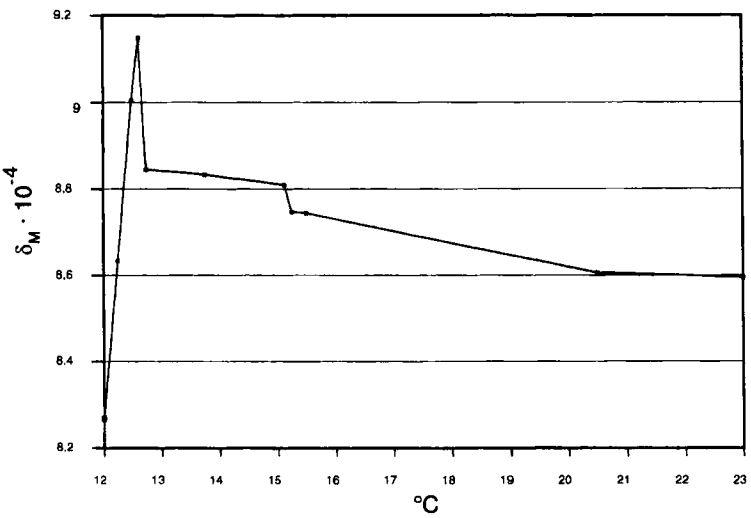

FIGURE 1 Logarithmic decrements of dampings of the viscometer containing the HgTl amalgam 30 a.t.%. Tl *versus* temperature (from 12°C to 23°C).

At the temperature of 15, 25°C we obtained $\delta = 8{,}7485 \cdot 10^{-4}$ and $\delta_0 = 3{,}27226 \cdot 10^{-4}$ (Ref. [4]). We may conclude that at this temperature the amalgam is completely solid.

These results are in accord to theoretical values obtained from Ref. [3]. In fact, from Ref. [3]

$$\delta = \frac{\delta_0 I_0 T}{I T_0}; \quad T = \frac{\pi T_0 I}{\sqrt{I_0[I(\pi^2 + \delta_0^2 T_0)] - \delta_0 I_0}} \tag{2}$$

where I_0 = the total moment of inertia of the system without the amalgam; $I = I_0 + 2\pi^2 R^3 a^2[1 + 3/4(a^2/R^2)]$; a, R and ρ have the same values as in Ref. [1]; T and T_0 are the period of the system with and without the amalgam, respectively (Ref. [4]).

Introducing experimental values obtained at the temperature of 15,25°C in formula (2), it derives:

$$\delta = 3{,}266830 \cdot 10^{-4}$$

The differences between experimental and theoretical values of δ at the above temperature is

$$\Delta_\delta = 5{,}5 \cdot 10^{-4}$$

For the temperature of 15,50°C we obtained

$$\Delta_\delta = 5{,}5 \cdot 10^{-4}$$

For the temperature of 20,50°C we obtained

$$\Delta_\delta = 5{,}3 \cdot 10^{-4}$$

For the temperature of 23°C we obtained

$$\Delta_\delta = 5{,}2 \cdot 10^{-4}$$

It follows that for temperature values higher than 23°C, $\delta = 3{,}364275 \cdot 10^{-4}$ and the amalgam is completely solid.

SUMMARY

The logarithmic decrements of the dampings of an oscillating viscometer in presence or absence (δ and δ_0, respectively) of the HgTl

amalgam at 30 at.% Tl has been measured at different temperatures, ranging from 12°C to 23°C. It has been found that the HgTl amalgam at 30 at.% Tl is completely solid at the temperature of 15,25°C with $\delta = 8{,}7485 \cdot 10^{-4}$ and $\delta_0 = 3{,}27226 \cdot 10^{-4}$. Furthermore, for temperature values higher than 23°C $\delta = 3{,}364275 \cdot 10^{-4}$, and the amalgam remains definitively solid.

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