The mechanism of destruction may be as follows. Electrons are lifted from the valence band into the conduction band by multiphoton processes. These conduction electrons are rapidly gaining enough energy in the intense laser beam to create further conduction electrons resulting finally in an electron avalanche which produces the damage. The existence of such a hot electron gas should manifest itself above the damage threshold by the emission of a broadband continuum which we have, in fact, observed between 400 and 800 mμ [5].

The incorporation of titanium in sapphire may prevent a development of the damaging electron avalanche in the following way: Ti probably replaces Al forming an acceptor state. Judging from the titanium induced strong UV-absorption at long wavelengths, the energy of this acceptor state appears to be situated several eV below the conduction band of the host crystal [6]. The presence of such low lying electron traps could effectively prevent the creation of conduction electrons in the host crystal, and thereby increase the damage threshold as observed.

The relation between UV-absorption and damage threshold provides a nondestructive method to select sapphires and rubies with a high damage threshold. Ruby crystals selected by this method showed increased operational lifetime and output when used as active elements in a Q-switched laser.

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The Electrical Conductivity of Solid and Molten Silver Iodide

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Several measurements of the electrical conductivity of molten and solid silver iodide were performed about 50 years ago [1–4]. The difference between the obtained results is more than 15%, and since little is known about the reliability of the difference investigations [5], we decided to remeasure the electrical conductivity of solid and molten silver iodide.

Some years ago we measured the thermoelectric power of molten silver iodide [6] and from the reproducibility of the results, we concluded that molten silver iodide is stable both in air and argon atmosphere up to at least 650 °C.

The conductivity cells were made of pure quartz [7] and the electrodes of bright platinum. Attempts were also made with silver electrodes, but no reproducible results were obtained. The conductivity was measured both in air and argon atmosphere, with cell constants of about 200 and 2000 cm^{-1}. The difference in the two runs was less than 0.2%. The used salt was of reagent quality (Hopkin & Williams) and was used without further purification.

The obtained specific electrical conductivities are given in Table 1 and are in excellent agreement with those obtained by Tubandt and Lorenz [3] both for the solid and for the melt (Fig. 1). The maximal difference is only 0.6%.

t (°C)	$\mathcal{H}$ (ohm^{-1} cm^{-1})	t (°C)	$\mathcal{H}$ (ohm^{-1} cm^{-1})
706.0	2.490	552.2	2.606
694.8	2.480	545.4	2.628
678.8	2.470	532.0	2.610
664.8	2.464	513.0	2.571
648.0	2.453	503.8	2.552
640.8	2.447	486.8	2.506
631.2	2.439	476.5	2.486
611.5	2.422	414.8	2.327
600.5	2.416	403.4	2.293
596.2	2.407	393.0	2.260
591.5	2.404	371.5	2.199
590.2	2.404	360.6	2.166
577.5	2.394	347.0	2.123
576.5	2.391	336.8	2.087
569.8	2.389	276.6	1.868
565.8	2.383	267.8	1.832
564.5	2.380	254.8	1.778
562.0	2.380	222.5	1.643
559.8	2.383		
554.8	2.499		

Table 1. The specific electrical conductivity of solid and molten silver iodide.

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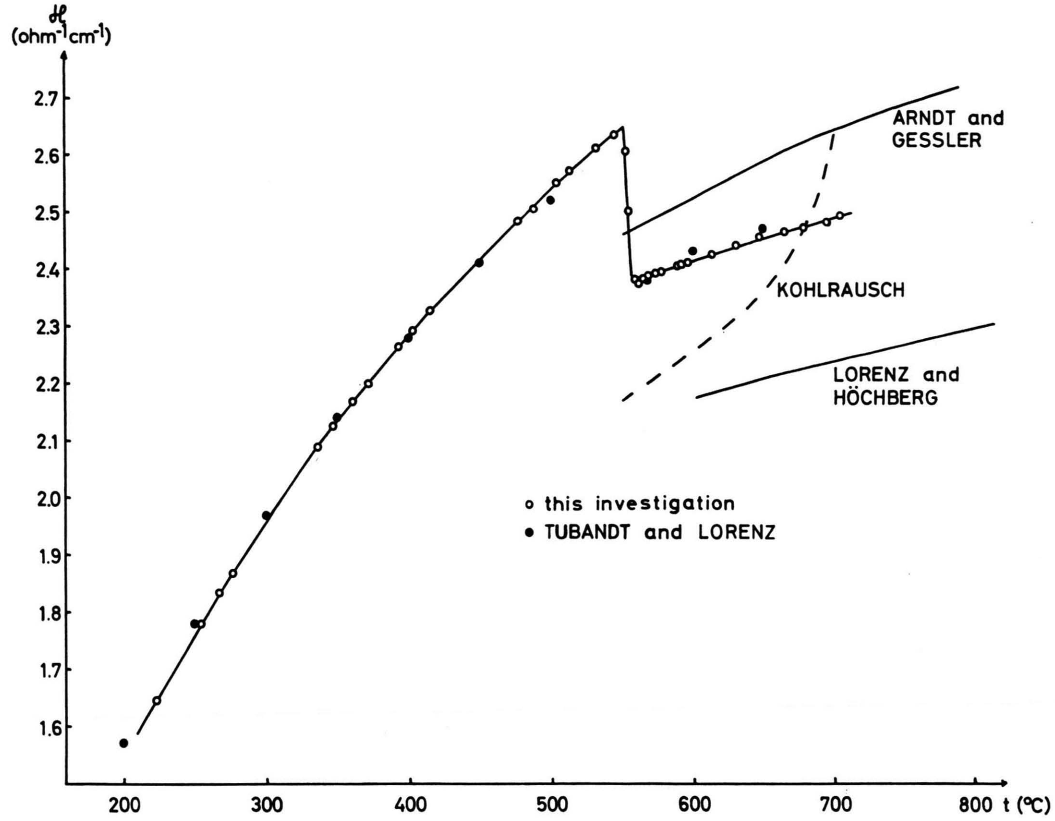

Fig. 1. The specific electrical conducticity of solid and molten silver iodide compared with previous investigations [1–4].

Silver iodide forms a cubic high temperature modification with very high mobility of the silver ions [8]. According to Fig. 1 this mobility is so high that the electrical conductivity decreases about 12% when the salt melts. Silver iodide is the only known salt, where there is a decrease in conductivity at the melting point. In Li_2SO_4 and $LiAgSO_4$, which also form cubic high temperature modifications, the increase is 30% and 8%, respectively [7]. An interesting observation is also that just before the solidification there is a small but significant decrease in the conductivity.

The specific conductivity of the melt can with good precision be described by a simple linear relation and

$$\mathcal{H} = 1.969 + 0.7405 \cdot 10^{-3}\, t, \quad (577 - 706\ ^\circ\mathrm{C})$$

where t is the temperature in °C. The standard deviation of $\mathcal{H}$ is 0.003 ohm^{-1} cm^{-1}.

For the solid we have used an Arrhenius' equation which gives

$$\mathcal{H} = 5.493 \exp(-1178/R\,T) \quad (222 - 532\ ^\circ\mathrm{C})$$

T is the temperature in °K and R the gas constant in cal./mole, degr. The standard deviation of $\mathcal{H}$ is 0.01 ohm^{-1} cm^{-1}.

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