

# Mixed valent magnetic TmSe alloys with TmTe and EuSe

**Doctoral Thesis**

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**Publication date:**

1979

**Permanent link:**

<https://doi.org/https://doi.org/10.3929/ethz-a-000164020>

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Diss ETH 6335

MIXED VALENT MAGNETIC TmSe:  
A THE DIELECTRIC RESPONSE  
B ALLOYS WITH TmTe AND EuSe

ABHANDLUNG

ZUR ERLANGUNG

DES TITELS EINES DOKTORS DER NATURWISSENSCHAFTEN

DER

EIDGENOESSISCHEN TECHNISCHEN

HOCHSCHULE ZUERICH

VORGELEGT VON

BERTRAM JOSEF RICHARD BATLOGG

DIPL.-PHYS. ETH ZUERICH

GEBOREN AM 11. AUGUST 1950

VON OESTERREICH

ANGENOMMEN AUF ANTRAG VON

PROF. DR. P. WACHTER, REFERENT

PROF. DR. H. C. SIEGMANN, KORREFERENT

1979

## Abstract

The optical reflectivity of TmS and of TmSe with varying degree of valence mixing has been measured in the photon energy range from 30 meV (and partially from 1 meV) up to 12 eV. Intraband absorption below about 2 eV causes the metallic high reflectivity and the metallic lustrous colour.

The anomalous excitation spectrum of  $\text{Tm}_{1.0}\text{Se}$  at low energy ( $<0.5$  eV) is attributed to the intermediate valence character of this compound, and is consistent with the model of d electrons and holes scattered from partially occupied f states at the Fermi level.

The most striking result stems from the analysis of the collective mode of the conduction band plasma: those electrons, whose partial f-character is responsible for the intermediate valence features in TmSe, participate in the "d-electron" plasma oscillation as if they had no f character at all.

The one particle excitations above  $\sim 2$  eV are well explained in terms of transitions from the p-valence band and from highly correlated 4f states into the double-structured 5d conduction band. A comparison with XPS spectra reveals an apparent difference for the value of the effective 4f Coulomb correlation energy as determined by the two experiments and points to different final state interactions.