

# Infrared lattice vibration spectra of monoclinic ZnP<sub>2</sub>

Sobotta H., Neumann H., Syrbu N. N., Riede V.

<https://doi.org/10.1002/pssb.2221150152>

Short Notes

K55

phys. stat. sol. (b) 115, K55 (1983)

Subject classification: 6 and 20.1; 22.3

Sektion Physik der Karl-Marx-Universität Leipzig<sup>1)</sup> (a) and  
Faculty of Physics, Polytechnic Institute of Kishinev (b)

Infrared Lattice Vibration Spectra of Monoclinic ZnP<sub>2</sub>

By

H. SOBOTTA (a), H. NEUMANN (a), N. N. SYRBU (b), and V. RIEDE (a)

The lattice vibrational properties of ZnP<sub>2</sub> which is known to crystallize in a monoclinic and tetragonal modification with space groups P 2<sub>1</sub>/c and one of the enantiomorphs P 4<sub>1</sub>2<sub>1</sub>2 or P 4<sub>3</sub>2<sub>1</sub>2, respectively /1/, have been studied in detail only in tetragonal ZnP<sub>2</sub> mainly by Raman scattering measurements /2 to 4/ but also by infrared reflectivity and absorption measurements /5, 6/. In the case of monoclinic ZnP<sub>2</sub> the only experimental data available at present is from unpolarized infrared transmission measurements on very thin samples with thicknesses in the range of about 3 μm from which approximate values for several transverse optical mode frequencies in the wave-number range  $\bar{\nu} = 200$  to 500 cm<sup>-1</sup> have been derived /6/. In the present communication we report the results of polarization-dependent infrared reflectivity measurements on sufficiently large vapour-grown monoclinic ZnP<sub>2</sub> single crystals with their twofold symmetry axis (b-axis) oriented parallel to the large surface plane of the samples. All measurements are made at room temperature in the wave-number range  $\bar{\nu} = 50$  to 4000 cm<sup>-1</sup>.

Monoclinic ZnP<sub>2</sub> contains eight molecules per unit cell which means that we have 72 phonon branches. According to group theory /7/ the irreducible representation of the phonon normal modes at the point  $\Gamma$  of the Brillouin zone is given by

$$\Gamma = 18 A_g \oplus 18 B_g \oplus 18 A_u \oplus 18 B_u$$

The even parity 18 A<sub>g</sub> and 18 B<sub>g</sub> modes are Raman active. Of the A<sub>u</sub> and B<sub>u</sub> modes one A<sub>u</sub> and two B<sub>u</sub> are acoustic modes whilst the remaining 17 A<sub>u</sub> and 16 B<sub>u</sub> modes are infrared active for the polarization directions  $\vec{E} \parallel \vec{b}$  and  $\vec{E} \perp \vec{b}$ , respectively.

The experimental reflectivity spectra observed in the wave-number range  $\bar{\nu} = 50$  to 500 cm<sup>-1</sup> are shown in Fig. 1. At  $\bar{\nu} > 500$  cm<sup>-1</sup> no additional

1) Linnéstr. 5, DDR-7010 Leipzig, GDR.