

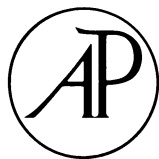
**HANDBOOK  
OF  
INFRARED STANDARDS II**  
With Spectral Coverage of  
1.4  $\mu\text{m}$ –4  $\mu\text{m}$  and 6.2  $\mu\text{m}$ –7.7  $\mu\text{m}$

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## SECTION III

### SATURATION ABSORPTION SPECTROSCOPY; UPDATE OF OsO<sub>4</sub> MEASUREMENTS

The latest high accuracy standards for some of the OsO<sub>4</sub> lines are presented in Tables C1 (page 612) and C2 (pages 613-616). They have been determined by using saturation absorption resonances of OsO<sub>4</sub> and CO<sub>2</sub>.

**TABLE C.1** Absolute Frequencies<sup>1</sup> of OsO<sub>4</sub> Lines Used as Secondary Frequency Standards in the Vicinity of CO<sub>2</sub> Laser Lines

Nearby <sup>12</sup> C <sup>16</sup> O <sub>2</sub> Laser Line	Absolute Frequency (kHz) of OsO <sub>4</sub> Reference Lines	Wavenumber vac. (cm <sup>-1</sup> )
P(24)	28 196 916 356.59 (0.68 )	940.547 889 186 (23)
P(22)	28 251 929 514.77 (0.68 )	942.382 930 620 (23)
P(20)	28 306 234 121.32 (0.14 )	944.194 337 314 4 (48)
P(18)	28 359 769 956.74 (0.83 )	945.980 100 565 (28)
P(16)	28 412 623 110.76 (0.82 )	947.743 092 015 (27)
<b>P(14)</b>	<b>28 464 676 938.787 (0.095)</b>	<b>949.479 420 819 4 (32)</b>
P(12)	28 516 051 989.12 (0.88 )	951.193 108 038 (29)
P(10)	28 566 630 371.3 (1.0 )	952.880 221 265 (35)
P( 8)	28 616 553 629.62 (0.95 )	954.545 481 915 (32)
P( 6)	28 665 682 602.40 (0.95 )	956.184 248 051 (32)
P( 4)	28 714 112 424.32 (0.64 )	957.799 693 024 (21)
R( 4)	28 923 030 675.2 (1.7 )	964.768 455 755 (58)
R( 6)	28 967 423 192.8 (1.4 )	966.249 230 752 (47)
R( 8)	29 011 137 371.4 (1.0 )	967.707 378 795 (33)
<b>R(10)</b>	<b>29 054 057 446.660 (0.050)</b>	<b>969.139 038 403 0 (17)</b>
R(12)	29 096 274 952.343 (0.058)	970.547 262 811 5 (19)
R(14)	29 137 747 033.57 (0.91 )	971.930 622 537 (31)
R(16)	29 178 468 914.7 (1.2 )	973.288 958 280 (39)
R(18)	29 218 450 029.5 (1.2 )	974.622 584 719 (41)
R(20)	29 257 633 822.8 (1.2 )	975.929 615 373 (39)
R(22)	29 296 146 358.18 (0.92 )	977.214 255 276 (31)
R(24)	29 333 876 263.32 (0.92 )	978.472 789 443 (31)
R(26)	29 370 814 078.409 (0.068)	979.704 902 329 8 (23)

<sup>1</sup> Ch. Chardonnet and Ch. J. Bordé, (Private Communication). This is an updated version of Table 1 of the previous handbook by Guelachvili and Rao. New measurements performed at LPTF (Paris) have been taken into account. [For R(10), see A. Clairon, B. Dahmani, O. Acef, M. Granvaud, Y.U.S. Domnin, S.B. Pouchkine, V. M. Tatarenkov, and R. Felder, *Metrologia* 25, 9-16 (1988): The frequency for R(10) of CO<sub>2</sub> given here is 29 054 072 700.965(0.050) kHz for which the wavenumber is 969.139 547 231 9(17)cm<sup>-1</sup>.

TABLE C.2.i Accurate Measurements<sup>1</sup> (with Assignments)<sup>2</sup> of Several Os O<sub>4</sub> Lines at 10.4 μm

Nearby CO <sub>2</sub> Laser Line	Os Isotope	Line Assignment	Absolute Frequency <sup>a</sup> (kHz)	Wavenumber <sup>a</sup> (cm <sup>-1</sup> )
P(24)	192	P(81) A <sub>1</sub> <sup>0</sup> (-)	28 197 056 189.19 (68)	940.552 553 500 (23)
P(22)	192	P(74) A <sub>1</sub> <sup>5</sup> (+)	28 251 929 514.77 (68)	942.382 930 620 (23)
P(20)	192	P(67) (?)	28 306 127 573.28 (19)	944.190 783 254 4(65)
	192	P(67) (?)	28 306 127 719.96 (19)	944.190 788 147 1(65)
	190	P(69) A <sub>1</sub> <sup>1</sup> (+)	28 306 359 584.29 ( 9)	944.198 522 308 6(63)
	189	P(70) A <sub>1</sub> <sup>1</sup> (-)	28 306 374 158.53 ( 5)	944.199 008 453 (12)
	192	P(60) A <sub>1</sub> <sup>4</sup> (-)	28 359 569 366.96 (83)	945.973 409 610 (28)
	192	P(60) (?)	28 359 583 609.87 (83)	945.973 884 702 (28)
P(18)	192	P(60) A <sub>1</sub> <sup>4-3</sup> (-)	28 359 591 916.49 (83)	945.974 161 781 (28)
	190	P(62) A <sub>1</sub> <sup>3-2</sup> (-)	28 359 617 962.60 (83)	945.975 030 586 (28)
	190	P(62) (?)	28 359 662 702.36 (83)	945.976 522 944 (28)
	190	P(62) (?)	28 359 666 115.20 (83)	945.976 636 784 (28)
	187	P(65) A <sub>1</sub> <sup>2-3</sup> (+)	28 359 758 554.74 (83)	945.979 720 235 (28)
	188	P(64) A <sub>1</sub> <sup>2</sup> (-)(?)	28 359 828 967.11 (83)	945.982 068 939 (28)
	188	P(64) A <sub>1</sub> <sup>2</sup> (-)(?)	28 359 835 411.54 (83)	945.982 283 902 (28)

<sup>1</sup> Ch. Chardonnet and Ch. J. Bordé, (Private Communication). In the case of <sup>189</sup>Os and <sup>187</sup>Os, the hyperfine structure has been fully resolved and the frequencies correspond to the center of gravity of the structure.

<sup>2</sup> B. Bobin, Ch. J. Bordé, Ch. Chardonnet, L. Henry and A. Valentin. Proceedings of the Xth Conference on high resolution molecular spectroscopy, Dijon, France. The notation of Landau-Berger has been adopted. The assignments with (?) are still uncertain.

<sup>a</sup> The estimated uncertainty in the last digits is given in parentheses.

TABLE C.2.ii (Continued)

Os O<sub>4</sub> Frequencies  
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Nearby CO <sub>2</sub> Laser Line	Os Isotope	Line Assignment	Absolute Frequency <sup>a</sup> (kHz)	Wavenumber <sup>a</sup> (cm <sup>-1</sup> )
P(16)	189	P(63) A <sub>1</sub> <sup>1</sup> (-)	28 359 837 050.86 (83)	945.982 338 584 (28)
	190	P(62) (?)	28 359 878 907.64 (83)	945.983 734 776 (28)
	190	P(62) (?)	28 359 883 229.68 (83)	945.983 878 943 (28)
	190	P(62) (?)	28 359 884 565.28 (83)	945.983 923 494 (28)
	190	P(62) A <sub>1</sub> <sup>3</sup> (-)	28 359 908 183.22 (83)	945.984 711 304 (28)
	190	P(62) (?)	28 359 913 265.66 (83)	945.984 880 836 (28)
P(14)	189	P(56) A <sub>1</sub> <sup>2</sup> (+)	28 412 365 663.17 (82)	947.734 504 488 (28)
	190	P(55) (?)	28 412 648 819.30 (82)	947.743 949 559 (27)
	187	P(58) A <sub>1</sub> <sup>1</sup> (+)	28 412 728 129.78 (82)	947.746 595 072 (27)
	189	P(49) A <sub>1</sub> <sup>3</sup> (-)	28 464 739 395.37 (11)	949.481 504 146 7(36)
P(12)	189	P(49) A <sub>1</sub> <sup>3</sup> (+)	28 464 742 138.75 (11)	949.481 595 656 0(37)
	190	P(48) A <sub>1</sub> <sup>1</sup> (+)(?)	28 464 746 562.03 (10)	949.481 743 200 7(34)
	190	P(48) A <sub>1</sub> <sup>1</sup> (+)(?)	28 464 755 528.33 (12)	949.482 042 284 3(39)
	192	P(46) A <sub>1</sub> <sup>2</sup> (-)	28 464 788 929.31 (10)	949.483 156 421 1(34)
	190	(?)	28 464 883 627.69 (11)	949.486 315 219 0(36)
	190	P(48) A <sub>1</sub> <sup>2</sup> (+)	28 464 888 460.64 (11)	949.486 476 428 9(36)
P(10)	192	P(39) A <sub>1</sub> <sup>3</sup> (-)	28 516 051 989.12 (88)	951.193 108 038 (29)
	192	P(39) A <sub>1</sub> <sup>2</sup> (+)	28 516 052 446.33 (88)	951.193 123 288 (29)
P( 8)	187	P(38) A <sub>1</sub> <sup>2</sup> (-)	28 566 884 676.9 (10)	952.888 703 989 (35)
	188	P(30) A <sub>1</sub> <sup>1</sup> (+)	28 616 371 073.35 (95)	954.539 392 494 (32)

TABLE C.2.iii (Continued)

Os O<sub>4</sub> Frequencies

Nearby CO <sub>2</sub> Laser Line	Os Isotope	Line Assignment	Absolute Frequency <sup>a</sup> (kHz)	Wavenumber <sup>a</sup> (cm <sup>-1</sup> )
P(8)	188	P(30) A <sub>1</sub> <sup>1</sup> (-)	28 616 553 629.62 (95)	954.545 481 915 (32)
R(6)	192	R(23) A <sub>1</sub> <sup>1</sup> (-)	28 967 504 893.9 (14)	966.251 956 007 (47)
	192	R(23) A <sub>0</sub> <sup>0</sup> (+)	28 967 602 799.8 (14)	966.255 221 796 (47)
R(8)	189	R(26) A <sub>0</sub> <sup>0</sup> (+)	29 011 181 441.9 (10)	967.708 848 830 (33)
	189	R(26) A <sub>0</sub> <sup>0</sup> (-)	29 011 266 499.1 (10)	967.711 686 032 (34)
R(10)	187	R(30) A <sub>1</sub> <sup>1</sup> (+)	29 054 016 716.063 (54)	969.137 679 776 5(18)
	187	R(30) A <sub>1</sub> <sup>1</sup> (-)	29 054 169 284.803 (71)	969.142 768 921 9(24)
	192	R(36) A <sub>0</sub> <sup>0</sup> (+)	29 054 231 144.19 (15)	969.144 832 329 1(50)
	192	R(36) A <sub>0</sub> <sup>0</sup> (-)	29 054 231 673.41 (15)	969.144 849 981 9(50)
	192	R(42) A <sub>3</sub> <sup>3</sup> (-)	29 096 042 436.04 (16)	970.539 506 902 6(54)
R(12)	190	R(40) A <sub>0</sub> <sup>0</sup> (+)	29 096 080 710.893 (77)	970.540 783 614 1(26)
	190	R(40) A <sub>0</sub> <sup>0</sup> (-)	29 096 085 508.633 (71)	970.540 943 649 5(24)
	190	R(40) A <sub>1</sub> <sup>1</sup> (+)	29 096 404 957.283 (71)	970.551 599 309 5(24)
	190	R(46) A <sub>3</sub> <sup>3</sup> (-)	29 137 848 760.40 (91)	971.934 015 778 (31)
R(14)	189	R(45) A <sub>0</sub> <sup>0</sup> (-)	29 137 927 780.59 (92)	971.936 651 608 (31)
	187	R(49) A <sub>1</sub> <sup>2</sup> (-)	29 178 325 373.3 (12)	973.284 170 254 (39)
	187	R(49) A <sub>1</sub> <sup>2</sup> (+)	29 178 468 914.7 (12)	973.288 958 280 (39)
	188	R(50) A <sub>2</sub> <sup>2</sup> (-)(?)	29 178 529 536.1 (12)	973.290 980 393 (39)
	192	R(55) A <sub>2-3</sub> <sup>2-3</sup> (-)	29 178 571 254.4 (12)	973.292 371 964 (39)
R(18)	189	R(57) A <sub>0</sub> <sup>0</sup> (+)(?)	29 218 273 695.2 (12)	974.616 702 838 (41)

TABLE C.2.iv (Continued)

Nearby CO <sub>2</sub> Laser Line	Os Isotope	Line Assignment	Absolute Frequency <sup>a</sup> (kHz)	Wavenumber <sup>a</sup> (cm <sup>-1</sup> )
R(18)	189	R(57) A <sub>1</sub> <sup>0</sup> (+) (?)	29 218 382 714.4	974.620 339 329 (41)
	189	(?)	29 218 407 574.2	974.621 168 562 (41)
	187	R(55) A <sub>1</sub> <sup>0</sup> (+)	29 218 542 755.8	974.625 677 735 (41)
	190	R(59) A <sub>1</sub> <sup>3</sup> (-)	29 218 631 278.7	974.628 630 542 (41)
R(20)	189	R(64) A <sub>1</sub> <sup>1</sup> (+)	29 257 467 463.6	975.924 066 227 (40)
	189	R(64) A <sub>1</sub> <sup>1</sup> (-)	29 257 512 517.1	975.925 569 052 (39)
	192	R(67) (?)	29 257 633 822.8	975.929 615 373 (39)
	190	R(65) A <sub>1</sub> <sup>1</sup> (-)	29 257 709 157.3	975.932 128 261 (39)
	189	R(64) A <sub>1</sub> <sup>2</sup> (+)	29 257 866 486.6	975.937 376 205 (39)
	192	R(74) A <sub>1</sub> <sup>0</sup> (+)	29 295 949 757.72	977.207 697 390 (31)
R(22)	192	R(74) A <sub>1</sub> <sup>0</sup> (-)	29 295 950 006.41	977.207 705 686 (31)
	192	R(73) A <sub>1</sub> <sup>0</sup> (+)	29 296 129 586.46	977.213 695 832 (31)
	187	R(67) A <sub>1</sub> <sup>0</sup> (-)	29 296 138 221.23	977.213 983 857 (31)
	190	R(71) A <sub>1</sub> <sup>1</sup> (-)	29 296 239 199.55	977.217 352 131 (31)
	189	R(76) A <sub>1</sub> <sup>1</sup> (+)	29 333 619 383.26	978.464 220 846 (31)
R(24)	192	R(80) A <sub>1</sub> <sup>2</sup> (-)	29 333 674 950.78	978.466 074 379 (31)
	187	R(74) A <sub>1</sub> <sup>0</sup> (+)	29 334 078 417.86	978.479 532 592 (31)
	187	R(74) A <sub>1</sub> <sup>0</sup> (-)	29 334 078 673.01	978.479 541 103 (31)
	187	R(80) A <sub>1</sub> <sup>1</sup> (+)	29 370 835 588.20	979.705 619 819 1(43)
R(26)	187	R(80) A <sub>1</sub> <sup>1</sup> (-)	29 370 880 770.30	979.707 126 931 8(43)
	192	R(85) A <sub>1</sub> <sup>1</sup> (+)	29 370 885 011.729 (74)	979.707 268 410 6(25)