**Supplementary Material**

**Shock Tube Rate Measurement and Uncertainty Data for H+O2+M=HO2+M**

**Table S1: Measured reaction rate coefficients for M=Ar**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Mixture | Temperature | Pressure | IDT | *k0* | Uncertainty |
| (K) | (atm) | m) | (cm6molecule-2s-1) | (+/-%) |
| 3%H2/1.5%O2/Ar | 1249 | 32.5 | 77 | 1.71E+15 | 9 |
| 3%H2/1.5%O2/Ar | 1240 | 32.4 | 101 | 1.72E+15 | 9 |
| 3%H2/1.5%O2/Ar | 1255 | 31 | 60 | 1.69E+15 | 9 |
| 3%H2/1.5%O2/Ar | 1262 | 31.5 | 47 | 1.64E+15 | 10 |
| 3%H2/1.5%O2/Ar | 1184 | 16.8 | 133 | 1.78E+15 | 12 |
| 3%H2/1.5%O2/Ar | 1196 | 16.9 | 90 | 1.76E+15 | 13 |
| 3%H2/1.5%O2/Ar | 1212 | 16.9 | 59 | 1.66E+15 | 13 |
| 3%H2/1.5%O2/Ar | 1196 | 17.4 | 97 | 1.70E+15 | 12 |
| 3%H2/1.5%O2/Ar | 1224 | 16.8 | 48 | 1.65E+15 | 16 |
| 3%H2/1.5%O2/Ar | 1214 | 17.1 | 60 | 1.67E+15 | 13 |
| 3%H2/1.5%O2/Ar | 1230 | 28.7 | 102 | 1.68E+15 | 9 |

**Table S2. Measured reaction rate coefficients for M=N2**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Mixture | Temperature (K) | Pressure | IDT | *k0* | Uncertainty |
| (atm) | s) | (cm6molecule-2s-1) | (+/-%) |
| 3%H2/1.5%O2/N2 | 1228 | 12.6 | 64 | 2.59E+15 | 12 |
| 3%H2/1.5%O2/N2 | 1201 | 12.7 | 126 | 2.43E+15 | 10 |
| 3%H2/1.5%O2/N2 | 1199 | 13 | 132 | 2.42E+15 | 10 |
| 3%H2/1.5%O2/N2 | 1225 | 12.6 | 69 | 2.39E+15 | 13 |
| 3%H2/1.5%O2/N2 | 1201 | 13.1 | 125 | 2.34E+15 | 10 |

**Table S3. Measured reaction rate coefficients for M=H2O**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Mixture | Temperature | Pressure | IDT | *k0* | Uncertainty |
| (K) | (atm) | (m) | (cm6molecule-2s-1) |
| 3%H2/1.5%O2/4.8%H2O/Ar | 1264 | 15.7 | 86 | 4.19E+16 | 20 |
| 3%H2/1.5%O2/3.9%H2O/Ar | 1307 | 16.6 | 26 | 3.60E+16 | 33 |
| 3%H2/1.5%O2/4.4%H2O/Ar | 1264 | 16.8 | 87 | 3.92E+16 | 21 |
| 3%H2/1.5%O2/9.7%H2O/Ar | 1288 | 16 | 105 | 3.48E+16 | 12 |
| 3%H2/1.5%O2/8.6%H2O/Ar | 1270 | 16.4 | 168 | 4.21E+16 | 12 |
| 3%H2/1.5%O2/9.1%H2O/Ar | 1344 | 15.5 | 32 | 3.79E+16 | 25 |
| 3%H2/1.5%O2/8.7%H2O/Ar | 1315 | 15.4 | 60 | 3.31E+16 | 16 |
| 3%H2/1.5%O2/9.0%H2O/Ar | 1329 | 15 | 48 | 3.39E+16 | 17 |
| 3%H2/1.5%O2/9.1%H2O/Ar | 1320.5 | 15.6 | 58 | 3.20E+16 | 15 |
| 3%H2/1.5%O2/13.8%H2O/Ar | 1376 | 15.1 | 37 | 3.40E+16 | 25 |
| 3%H2/1.5%O2/13.0%H2O/Ar | 1282 | 15.5 | 195 | 4.08E+16 | 10 |

**Table S4. Measured reaction rate coefficients for M=CO2**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Mixture | Temperature (K) | Pressure | IDT | *k0* | Uncertainty |
| (atm) | (m) | (cm6molecule-2s-1) | (+/-%) |
| 3%H2/1.5%O2/20%CO2/Ar | 1223 | 19 | 217 | 7.75E+15 | 20 |
| 3%H2/1.5%O2/20%CO2/Ar | 1267.5 | 18.5 | 93 | 9.36E+15 | 18 |
| 3%H2/1.5%O2/20%CO2/Ar | 1203 | 17.4 | 281 | 6.96E+15 | 23 |
| 3%H2/1.5%O2/20%CO2/Ar | 1235 | 18.4 | 178 | 8.68E+15 | 18 |
| 3%H2/1.5%O2/20%CO2/Ar | 1189 | 11.9 | 221 | 7.30E+15 | 23 |
| 3%H2/1.5%O2/20%CO2/Ar | 1185.5 | 12.3 | 236 | 6.74E+15 | 25 |
| 3%H2/1.5%O2/20%CO2/Ar | 1191 | 11.5 | 210 | 7.71E+15 | 22 |
| 3%H2/1.5%O2/20%CO2/Ar | 1228 | 11.7 | 118 | 9.78E+15 | 19 |
| 3%H2/1.5%O2/20%CO2/Ar | 1185 | 12.1 | 234 | 6.81E+15 | 25 |
| 3%H2/1.5%O2/20%CO2/Ar | 1224 | 16.4 | 191 | 8.43E+15 | 19 |
| 3%H2/1.5%O2/20%CO2/Ar | 1238 | 16.1 | 144 | 9.09E+15 | 18 |
| 3%H2/1.5%O2/10%CO2/Ar | 1180 | 11.7 | 189 | 9.37E+15 | 39 |
| 3%H2/1.5%O2/10%CO2/Ar | 1179 | 11.3 | 173 | 9.07E+15 | 42 |