

Supplementary Materials

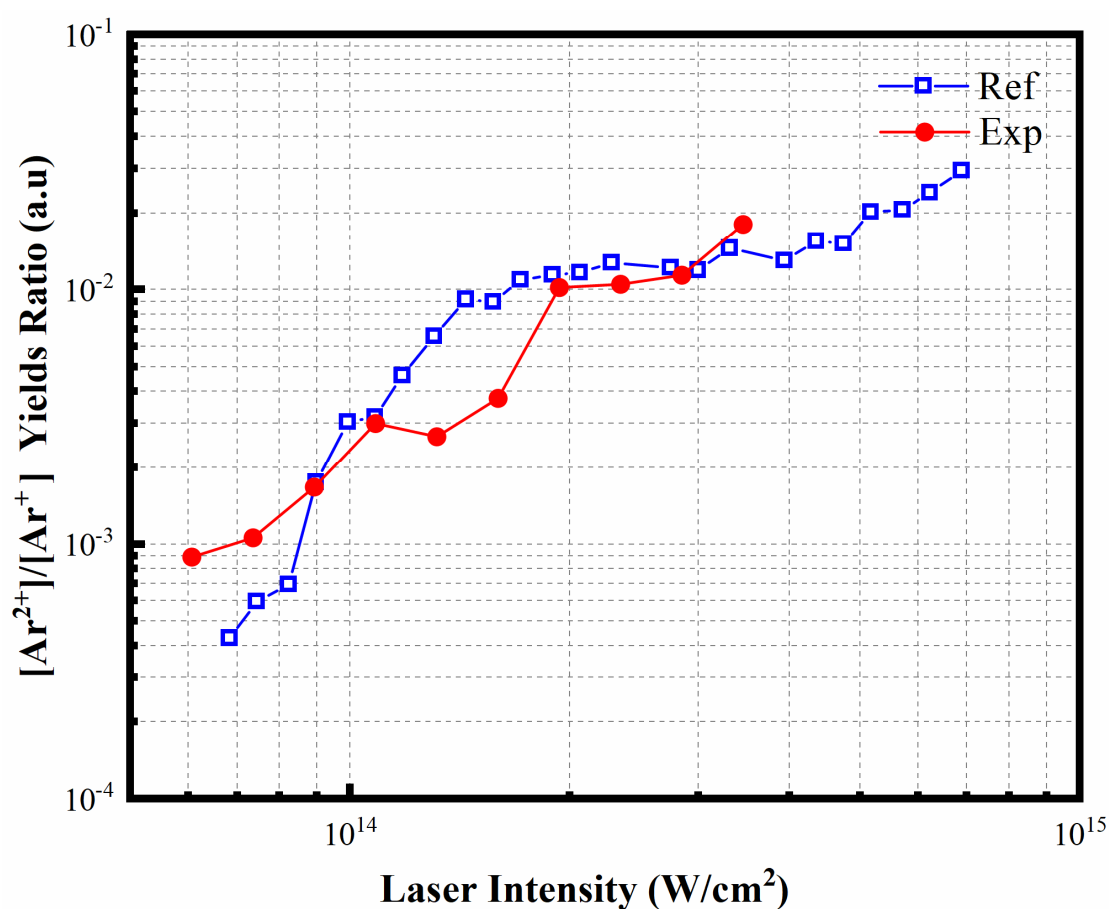


Figure S1. The yield ratio of $[Ar^{2+}]/[Ar^+]$ of our measurement comparing with the same ratio in literatures Ref [1]. The red solid square is the experimental results.

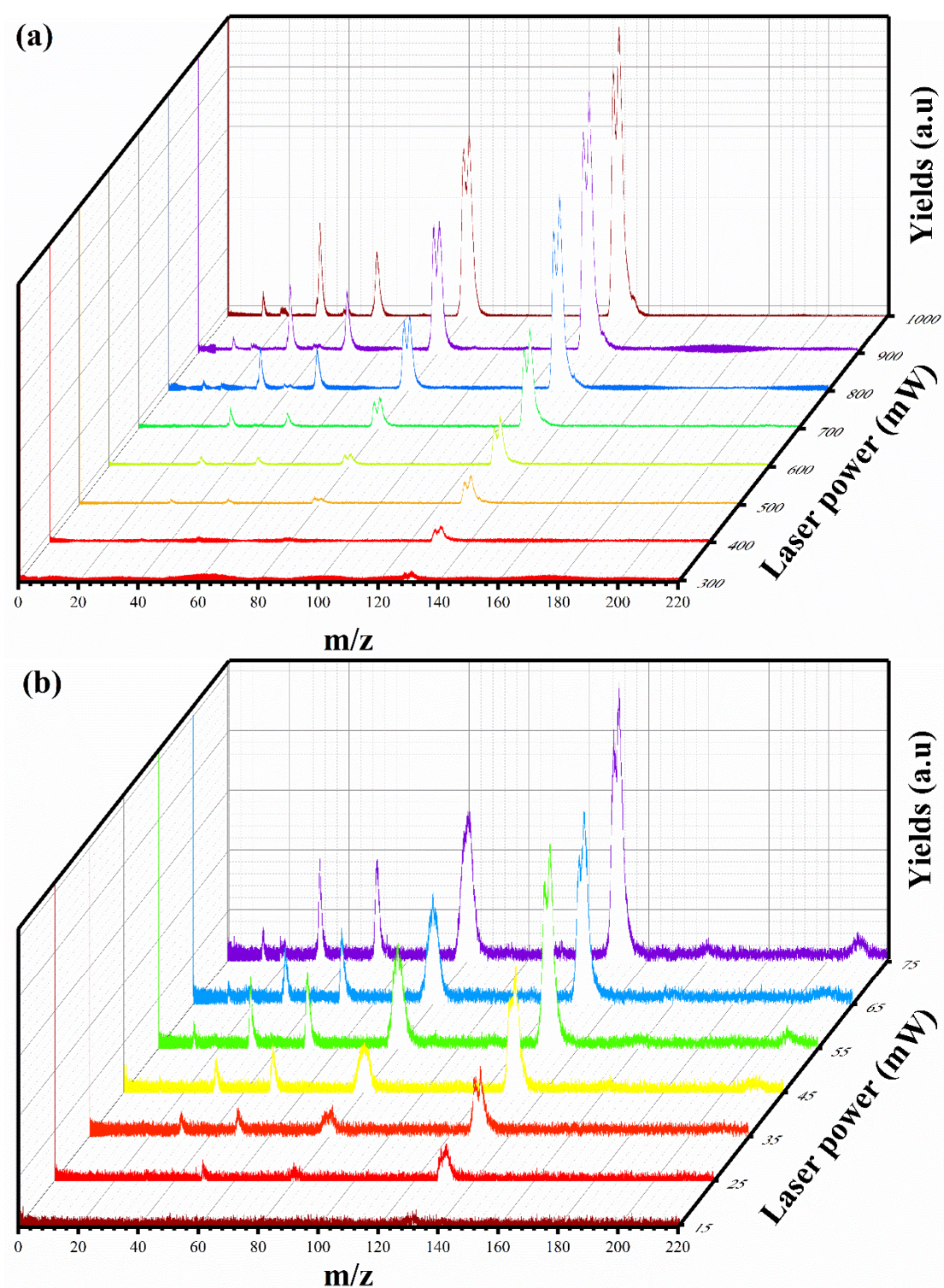
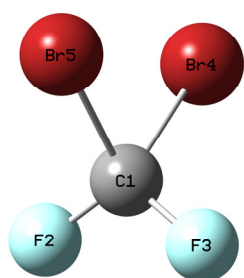


Figure S2. The time-of-flight mass spectra under different laser power, in the (a) 800nm laser field; (b) 400nm laser field, respectively.

Table S1. The compliance matrix of singly charged ion CF_2Br_2^+ and CF_2Br^+ , which is calculated by B3LYP level of theory using 6-31G* basis set.

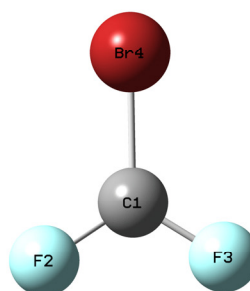
Bond	CF_2Br_2^+				CF_2Br^+	
	C-F(2)	C-F(3)	C-Br(4)	C-Br(5)	C-F(2)	C-Br(4)
C-F(2)	0.142				0.113	
C-F(3)	-0.012	0.142			-0.012	0.113
C-Br(4)	-0.033	-0.033	0.688		-0.016	-0.012
C-Br(5)	-0.033	-0.033	-0.212	0.688		0.239

(a)



C-F: 7.04 mdyn/Å
C-Br: 1.45 mdyn/Å

(b)



C-F: 8.85 mdyn/Å
C-Br: 4.18 mdyn/Å

Figure S3. (a) the optimized structure of singly charged ion CF_2Br_2^+ at the B3LYP/6-31G* level and the related C-F and C-Br bonds strength calculated by the relax force constant (b) the optimized structure of singly charged ion CF_2Br^+ at the B3LYP/6-31G* level and the related C-F and C-Br bonds strength calculated by the relax force constant[2].

Reference

1. Guo, C.; Li, M.; Nibarger, J. P.; Gibson, G. N., *Physical Review A* 1998, 58, R4271-R4274.
2. Brandhorst, K.; Grunenberg, J., *Chemical Society Reviews* 2008, 37, 1558.