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Ablation dynamics of Co/ZnS targets under two-pulse femtosecond laser irradiation

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Transition metal doped II-VI materials are widely investigated for applications as diluted magnetic semiconductors (DMS) [1]. Fundamental insight into the interaction dynamics of fs laser pulses with suitable Co/Zn/S targets can provide information on the temporal regime in which the laser energy couples with different ablation pathways and can help to design strategies for the controlled growth of the above materials by pulsed laser ablation and deposition (PLD).

In this work, we have investigated the ultrafast laser ablation dynamics of Co/ZnS targets with a pump-and-probe femtosecond laser scheme. The ion composition of the ablation plasma at different delays and relative fluences of the pump and probe pulses is studied by time-of-flight mass spectrometry. The results show that, for pump and probe pulses of different fluence, higher ion yields are obtained when the fluence of the pump pulse is lower than that of the probe pulse. Through the comparison between the ablation dynamics obtained at different double pulse configurations, some understanding has been gained on the way in which the transient modifications, induced in the material surface by the first pulse, affect the coupling of the delayed pulse with the irradiated layer.

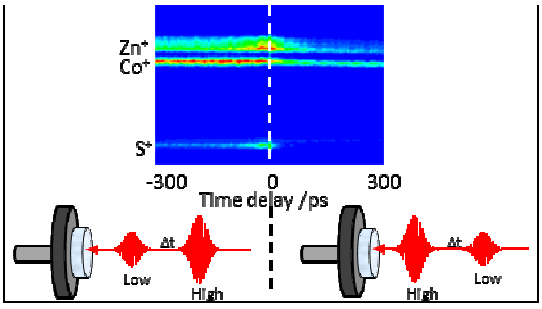

Figure: Asymmetric ion yields obtained by ablation of Co/ZnS targets with two unequal fs pulses.

References

[1] K. R. Kittilstved, W. K. Liu, D. R. Gamelin, Nature Mater. 5, 291 (2006).