Journal **XX** (XXXX) XXXXXX https://doi.org/10.1088/1361-6528/ab94da

Supplementary Information

Matrix-specific mechanism of Fe Ion release from laser-generated 3D-printable nanoparticle-polymer composites and their protein adsorption properties

Yaya Li[1], Christoph Rehbock[1], Milen Nachev[2,3], Jacqueline Stamm[4], Bernd Sures[2,3], Andreas Blaeser [4] and Stephan Barcikowski[1]

[1] Technical Chemistry I and Center for Nanointegration Duisburg-Essen (CENIDE), University of Duisburg-Essen, Universitätsstr. 5-7, 45141 Essen, Germany
[2] Aquatic Ecology, University of Duisburg-Essen, Universitätsstr. 5, 45141 Essen, Germany
[3] Center for Water and Environmental Research, University of Duisburg-Essen, Universitätsstr. 5, 45141 Essen, Germany
[4] BioMedical Printing Technologies, Technische Universität Darmstadt, Magdalenenstraße 2, 64289 Darmstadt, Germany

E-mail: stephan.barcikowski@uni-due.de

https://doi.org/10.1088/1361-6528/ab94da

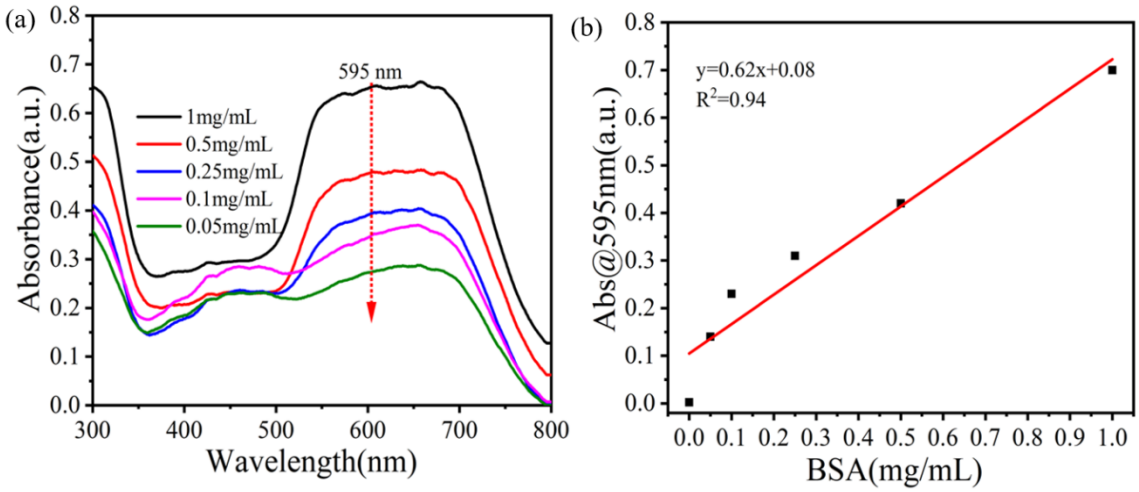

Figure S1. Calibration curves (b) for standard BSA aqueous protein solution, extracted from the absorbance at 595 nm of the UV-vis extinction spectra (a).

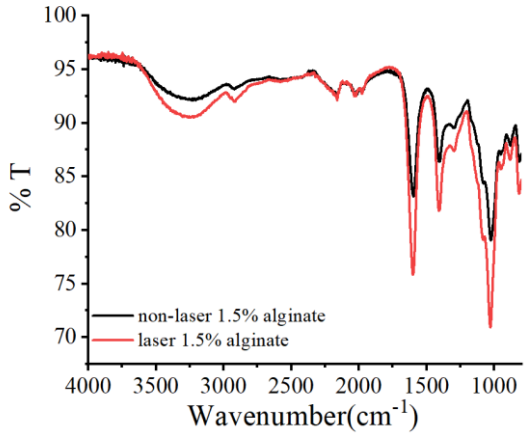

Figure S2. Fourier-transform infrared spectroscopy (FTIR) spectra of laser or non-laser ablation alginate. The samples were characterized by the device of FT/IR-430, Jasco.

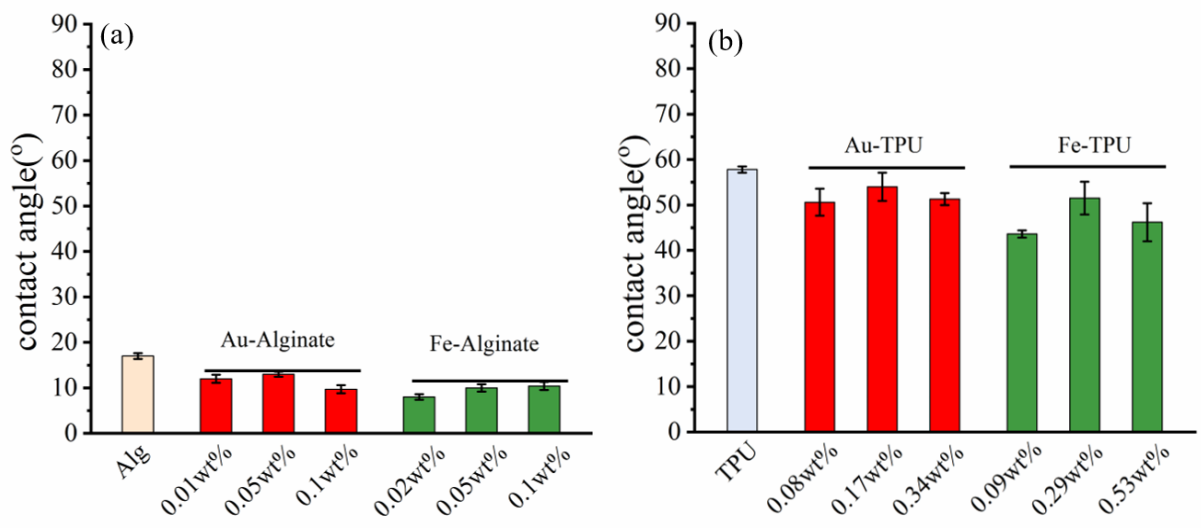

Figure S3. Contact angles of different loadings of Au and Fe nanoparticles in alginate (a) and TPU (b) measured by captive bubble method.

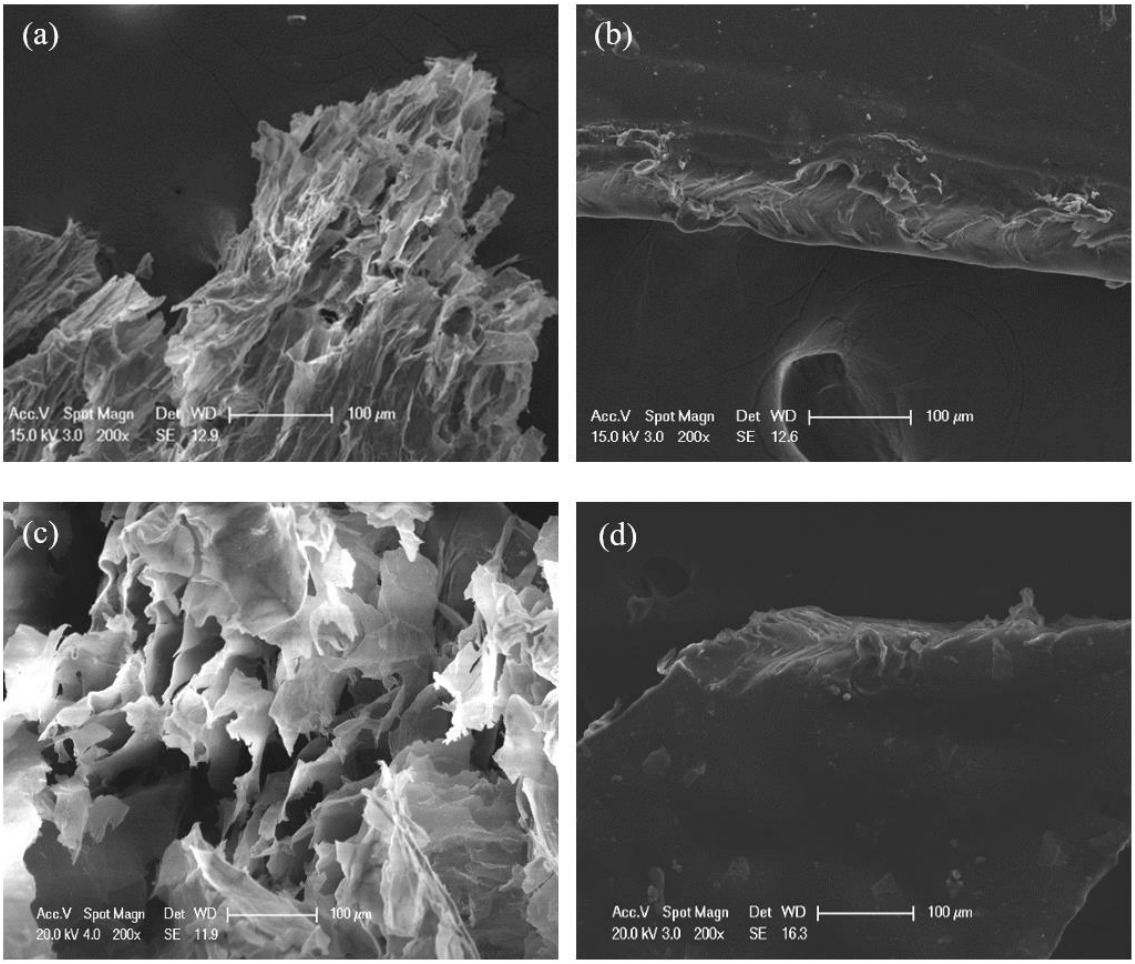

Figure S4. SEM images of alginate (a), TPU (b), Fe-alginate (c) and Fe-TPU (d). The microstructure of samples was characterized by scanning electron microscopy (SEM, Philips XL 30).

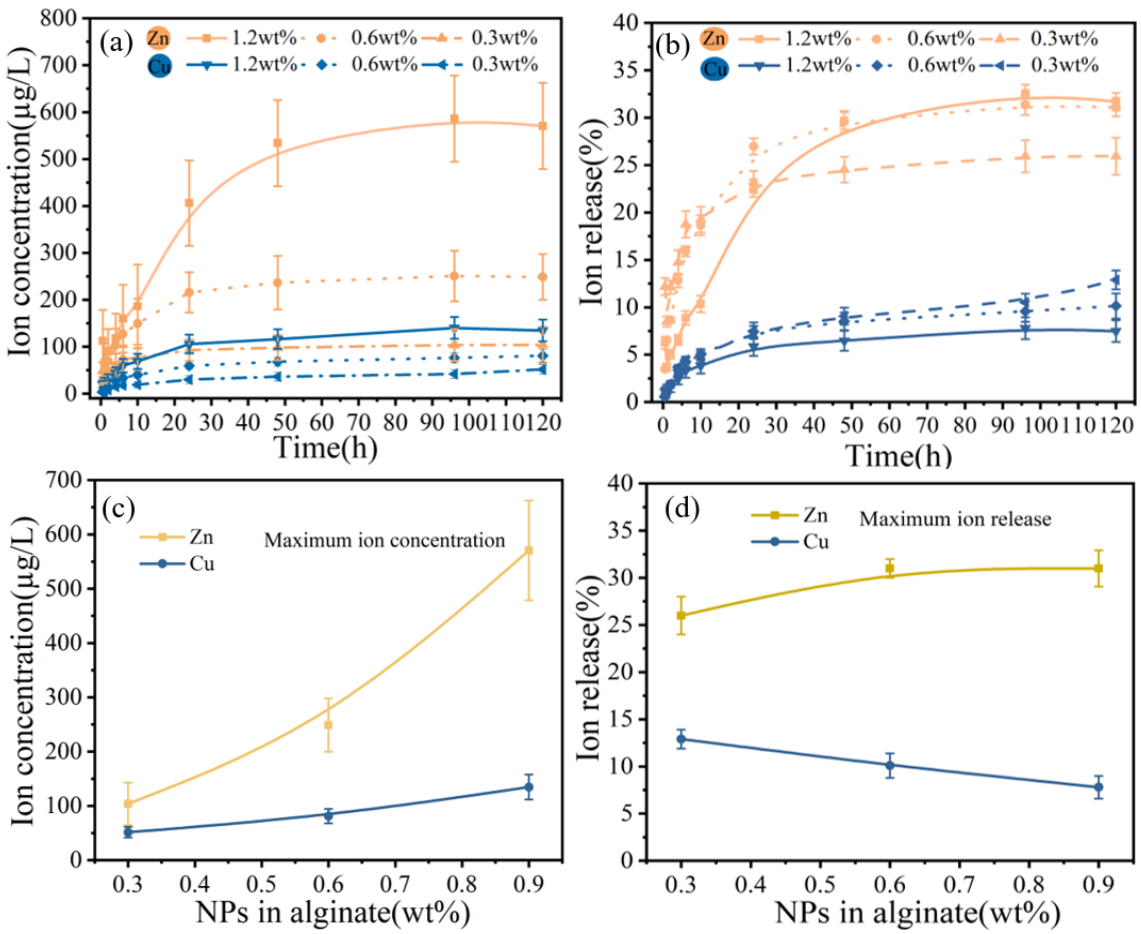

Figure S5. Long-term ion release kinetics in the air-saturated buffer: (a) released Zn and Cu ion concentration of laser-generated nanoparticle-alginate composite, (b) ions released percent of different nanoparticles amount in alginate, (c) maximum ion concentration and (d) maximum ion released percent of different nanoparticles amount in 1.5% m/v alginate.

Table S1. Literature values of ions diffusion coefficients at infinite dilution.

Ion	T(K)	D (10^{-6} cm^2/s)	Ref
Fe^{2+}	293	6.28	[1]
	298	7.19	[2]
Fe^{3+}	293	5.78±0.23	[1]
	298	6.04	[2]
Zn^{2+}	293	6.14	[1]
	298	7.03	[2]
Cu^{+}	293	6-8	[3]
	298	7.3	[3]
Cu^{2+}	293	5.0	[3]
	298	7.14	[2]

Table S2. Calculated solubility product constant (K_{sp}) for metal oxides nanoparticles in DI water at 25 ºC.

NPs	K_{sp}	Ref
$Cu(OH)_2$	4.2×10^{-21}	[4]
$Fe(OH)_2$	2×10^{-15}	[4]
	4.87×10^{-17}	[2]
$Fe(OH)_3$	1.55×10^{-39}	[4]
	2.79×10^{-39}	[2]
$Zn(OH)_2$	7.6×10^{-17}	[4]
	3×10^{-17}	[2]

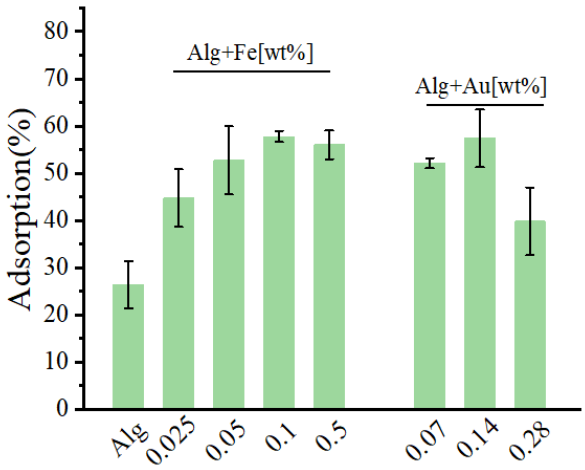

Figure S6. Collagen I protein adsorption percentage on the nanoparticle-alginate composite gels.

References

[1] Rodushkin I, Stenberg A, Andrén H, Malinovsky D and Baxter D C 2004 Isotopic Fractionation during Diffusion of Transition Metal Ions in Solution *Anal. Chem.* **76** 2148
[2] Haynes W M. 2012-2013 *CRC Handbook of Chemistry and Physics.* 93 ed.; New York CRC press
[3] Stricker E, Adler Z, Wainright J and Savinell R 2019 Diffusion Coefficients of Cuprous and Cupric Ions in Electrolytes with High Concentrations of Bromide Ions *J. Chem. Eng. Data* **64** 1095
[4] Benjamin M M 2002 *Water Chemistry* 1st ed New York McGraw-HillCompanies Inc.