Supplementary Materials: Analytical Solutions for the Material Deposition by Laser-Induced Forward Transfer

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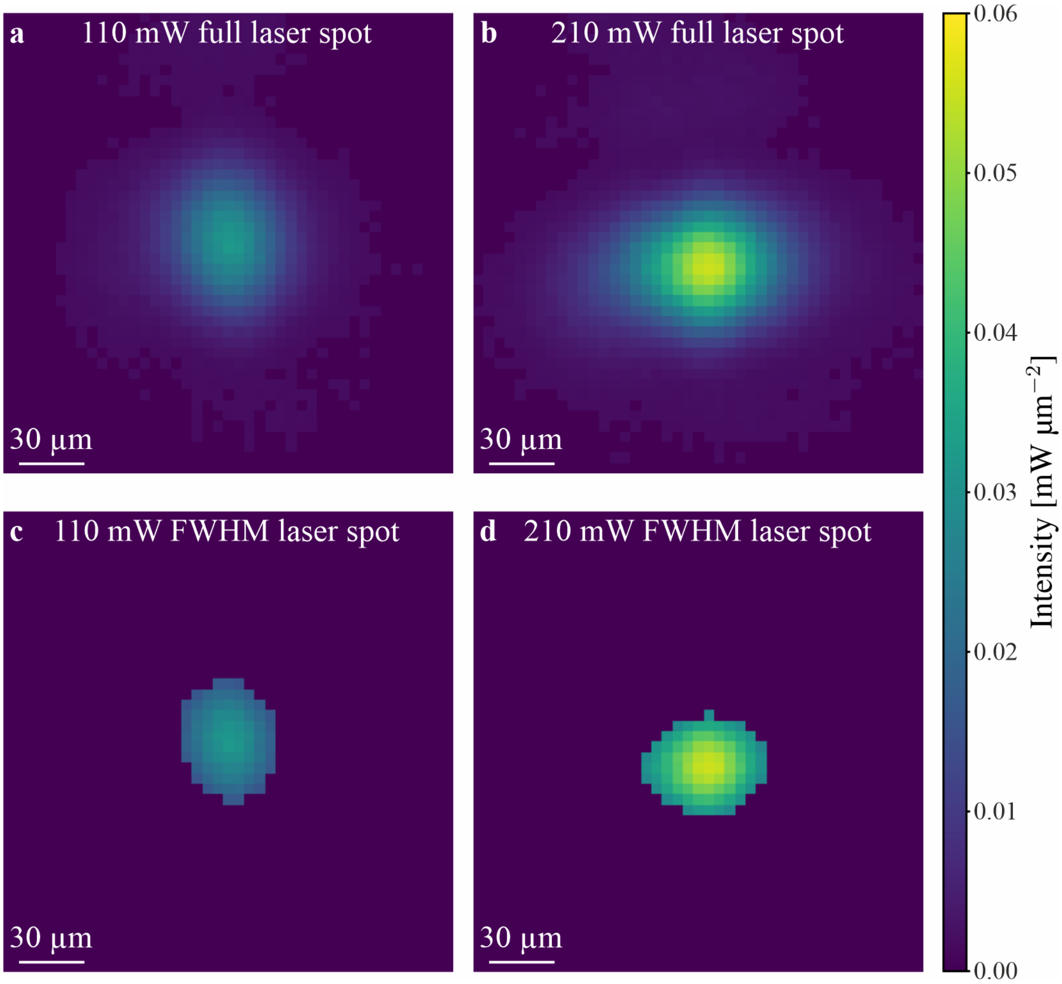

Figure S1. Laser spot intensity measurement: The measured full laser spot intensity of the used 405 nm wavelength laser is shown with an incident laser power of 110 mW (**a**) and 210 mW (**b**). In addition, the FWHM laser spot diameter of ≈ 50 µm is shown with an incident laser power of 110 mW (**c**) and 210 mW (**d**), which is calculated by $\omega = 2\sqrt{r_v r_h}$.

Table S1. Model parameters: Model fitting parameters for the spot width, spot volume, and maximum polyimide expansion, as well as the root-mean-square deviation (RMSD) of the predicted time progression.

	$\bar{\alpha}/\bar{\beta}/\bar{\gamma}$ $\left[\mu m^{-1}\right]$	k $\left[ms^{-1}\right]$	$V_{min}/d_{min}/h_{P,min}$ $\left[\mu m^3/\mu m/\mu m\right]$	RMSD $\left[\mu m^3/\mu m/\mu m\right]$
V_T	$7.59 \cdot 10^{-2}$	$1.21 \cdot 10^{-1}$	$1.83 \cdot 10^{2}$	$20.65 \cdot 10^{0}$
d_T Fluo	$5.43 \cdot 10^{0}$	$1.95 \cdot 10^{-1}$	$3.57 \cdot 10^{2}$	$14.57 \cdot 10^{0}$
d_T VSI	$4.58 \cdot 10^{0}$	$1.40 \cdot 10^{-1}$	$2.84 \cdot 10^{2}$	$11.51 \cdot 10^{0}$
h_P	$6.12 \cdot 10^{-1}$	$4.64 \cdot 10^{-1}$	$3.50 \cdot 10^{1}$	$12.57 \cdot 10^{0}$

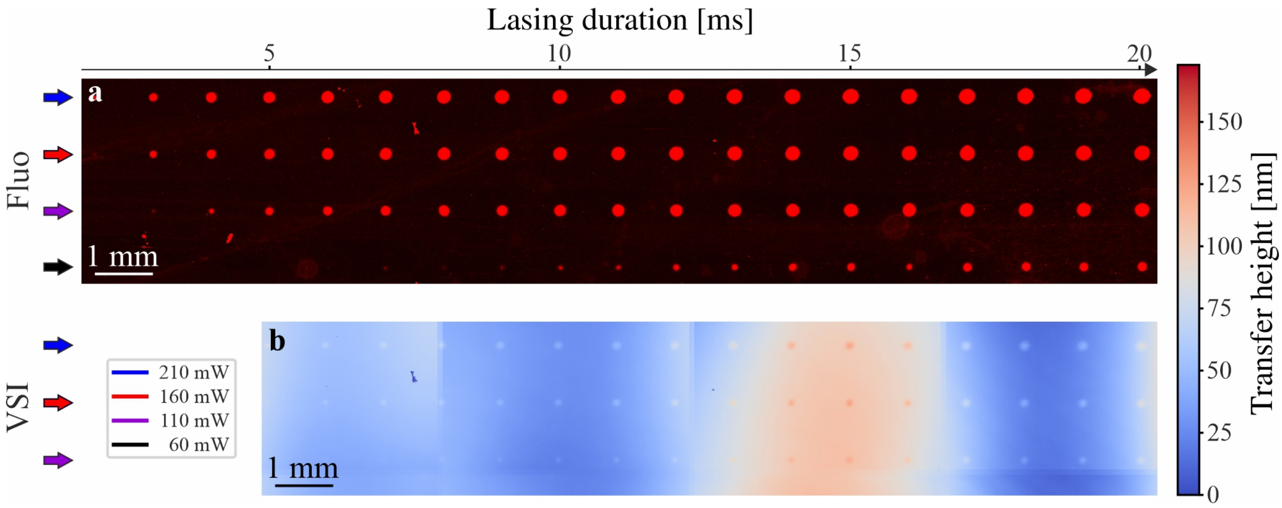

Figure S2. Rhodamine 150 donor substrate: Example of an analyzed Rhodamine 150 donor substrate material deposition (fluorescence imaging (Fluo; **a**) and vertical scanning interferometry (VSI; **b**)) through a ranging lasing duration (2 ms – 20 ms) and varying lasing powers (60 mW, 110 mW, 160 mW, and 210 mW).

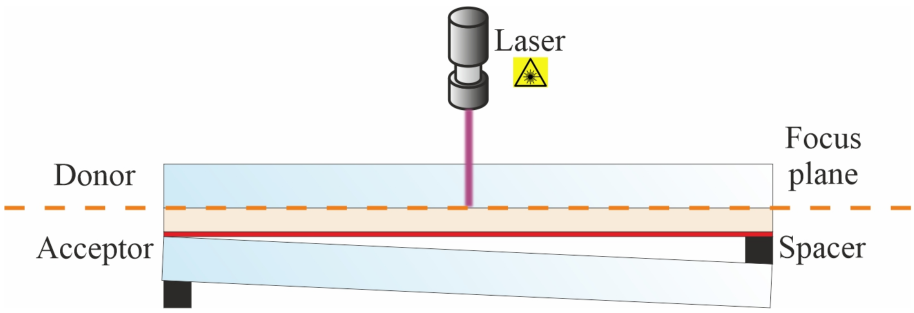

Figure S3. Material deposition with an acceptor-donor substrate distance: Two 200 µm spacers were attached on opposing sides of an acceptor substrate, one beneath and one above, to transfer material with a range of acceptor-donor substrate distances.

Table S2. Spin-coating parameters: Approximated values for ρ_{SLEC} through polystyrene [1] and polyacrylic acid [2] .

Parameter	Value	Unit
ρ_{DCM}	1330	$kg\,m^{-3}$
ρ_{SLEC}	≈ 1100	$kg\,m^{-3}$
$D_{DCM/air}$	$10.37 \cdot 10^{-6}$ [3]	$m^2\,s^{-1}$
P_{DCM}	$47 \cdot 10^3$	Pa
M_{DCM}	$84.9 \cdot 10^{-3}$	$kg\,mol^{-1}$
R	8.3145	$kg\,m^2\,s^{-2}\,mol^{-1}\,K^{-1}$
T	296.15	K
f	80	s^{-1}

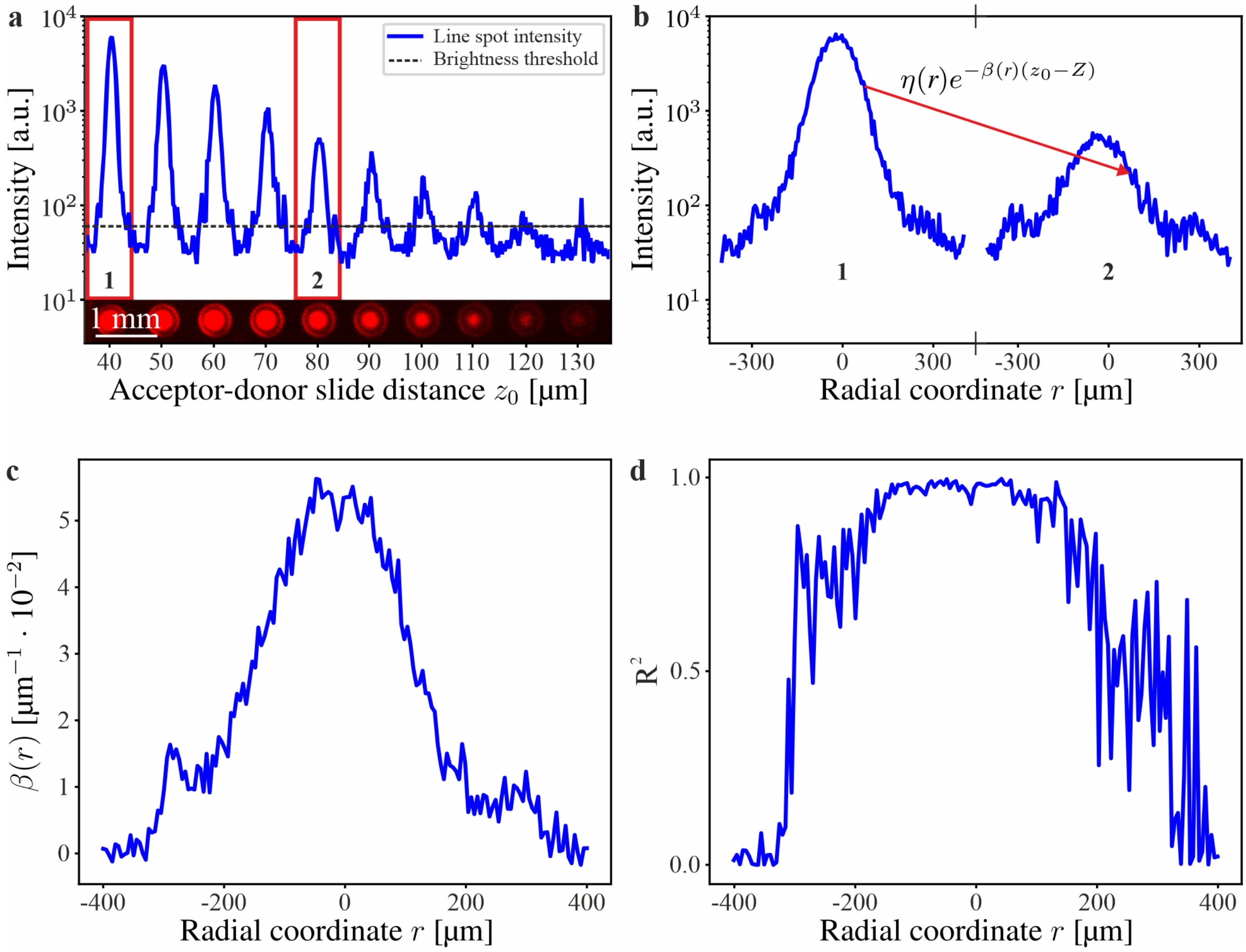

Figure S4. Experimental identification of the ejection-based material deposition $R(r)|_{z_0}$: Experimental identification of $R(r)|_{z_0}$ for the material deposition of a Rhodamine 150 donor substrate with 160 mW and 10 ms lasing power and duration over an acceptor-donor substrate distance $z_0 \in [40\,\mu m, 130\,\mu m]$. To obtain $R(r)|_{z_0}$ (**a** and **b**), which describes the line intensity of a deposited spot with acceptor-donor substrate distance z_0, the coefficient $\beta(r)$ has to be measured (**c**). For completeness, the R^2 score of each $\beta(r)$ was included (**d**).

Table S3. Coating thickness calculation: Exponential fit of the kinematic viscosity ν and the calculated coating thickness h [4]. The viscosity (dissolved in DCM with 3 different concentrations; 70 mg mL^{-1}, 100 mg mL^{-1}, and 135 mg mL^{-1}) was measured with a Shear Rheometer Anton Paar MCR 301 in the cone-plate mode rotating between 1000 and 3000 rounds per minute at 20 °C.

$$\nu = 1.62 \cdot 10^{-7} + 1.82 \cdot 10^{-7} e^{\frac{x_0}{0.0323}}$$

$$h \cong 0.85 x_0 \frac{\rho_{DCM}}{\rho_{SLEC}} \left[\frac{\nu \sqrt{D_{DCM/air}} P_{DCM} M_{DCM}}{(2\pi f)^{\frac{3}{2}} \rho_{DCM} RT} \right]^{\frac{1}{3}}$$

Mass ratios x_0	h [nm]
0.010	54
0.020	115
0.030	185
0.040	267
0.125	1872

References

1. Polystyrol (PS). Available online: https://www.kern.de/cgi-bin/riweta.cgi?nr=2101&lng=1 (accessed on 06.12.2021).
2. F. Bracher, P- Heisig, P. Langguth, E. Mutschler, G. Rücker, T. Schirmeister, G. K. E. Scriba, E. Stahl-Biskup, R. Troschütz. In *Arzneibuch-Kommentar*; Govi-Verlag: Eschborn, GER, 2018.
3. G. A. Lugg. Diffusion coefficients of some organic and other vapors in air. *Anal. Chem.* **1968**, *40*, 1072–1077.
4. J. Danglad-Flores, S. Eickelmann, H. Riegler. Evaporation behavior of a thinning liquid film in a spin coating setup: Comparison between calculation and experiment. *Eng. Rep.* **2021**, *3*, e12390.