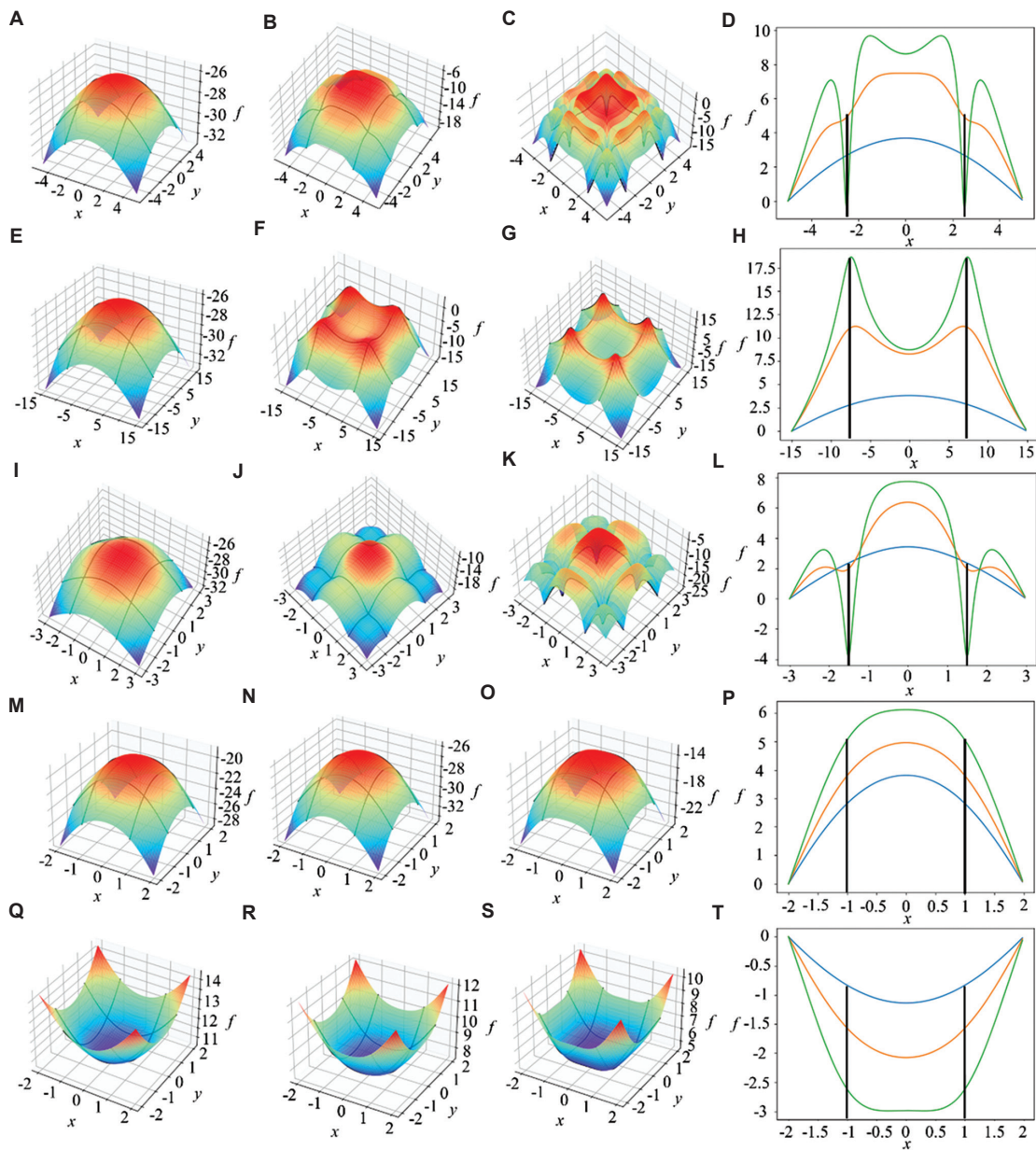**RESEARCH ARTICLE**

A holistic model for melt electrowritten three-dimensional structured materials based on residual charge

Supplementary File

Figure S1. Modes of energy surface evolution under different conditions. Each row represents a mode of evolution, whose conditions correspond to each row in Table S1. α and K are kept at 3 and 1 for all modes, respectively. The blue, orange, and green curves correspond to z_1, z_2, and z_3 in Table S1, respectively.
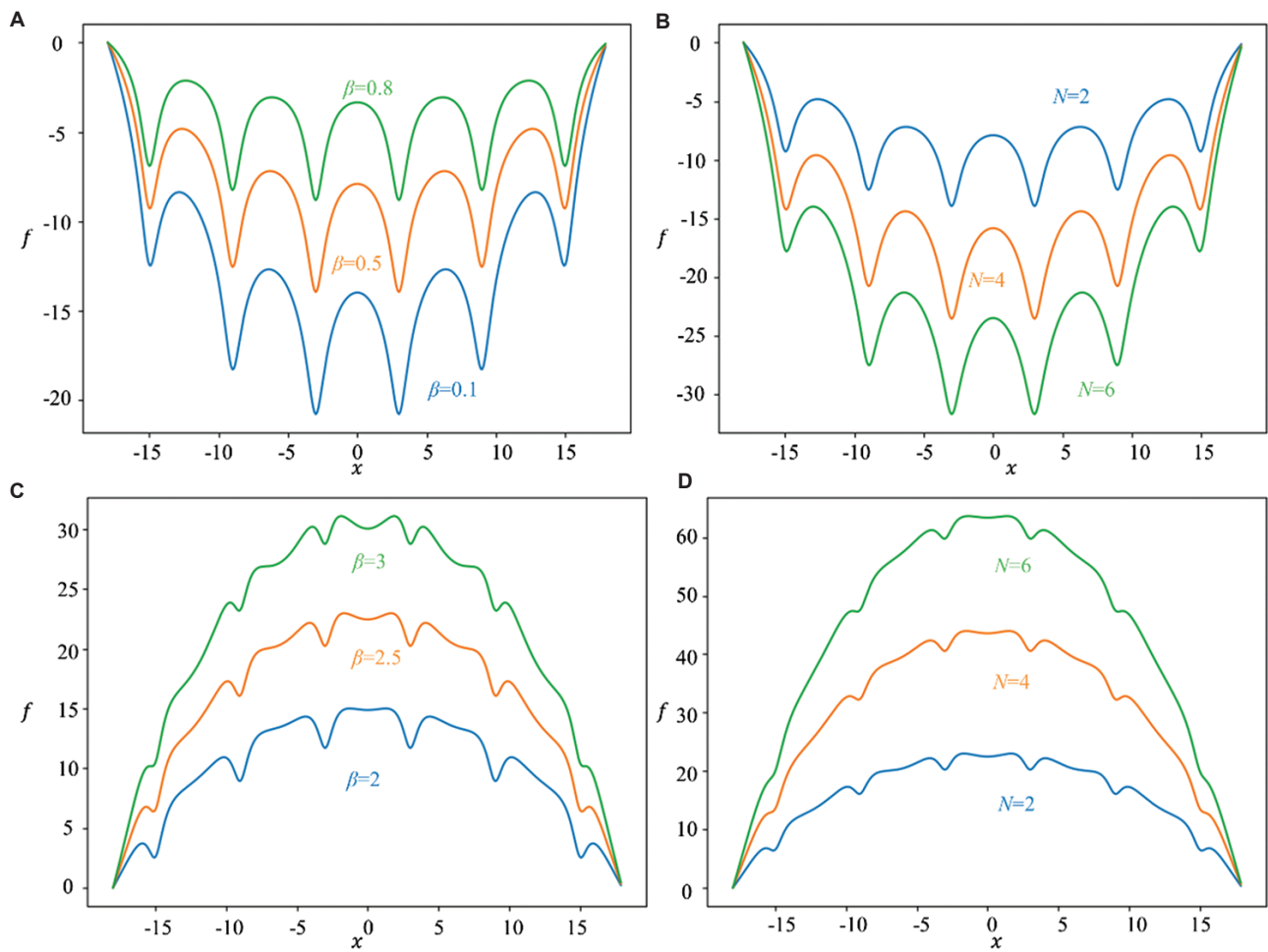
Figure S2. Comparison of lateral characteristic curves when β and N are altered at a constant z. N is the number of layers considered to contribute to the energy surface. The proposed model is generalized herein so that N can be altered. For example, $N = 4$ means the topmost four layers that are taken into consideration. $N = 2$ is selected for the proposed model throughout the main text of the study. (A) and (C) show the effect of β when $\beta < 1$ or $\beta > 1$. (B) and (D) show the effect of N when $\beta < 1$ or $\beta > 1$. By comparison (A) and (B) or (C) and (D), when $\beta < 1$, increase of N is equivalent to decrease of β; while when $\beta > 1$, increase of N is equivalent to increase of β. For (A–D), $\alpha = 3$, $\eta = 1$, $\xi = 6$, $K = 3$, $z = 1.5$. For (A) and (C), $N = 2$. For (B) and (D), $\beta = 0.5$ and 2.5, respectively.

A

B

C

D
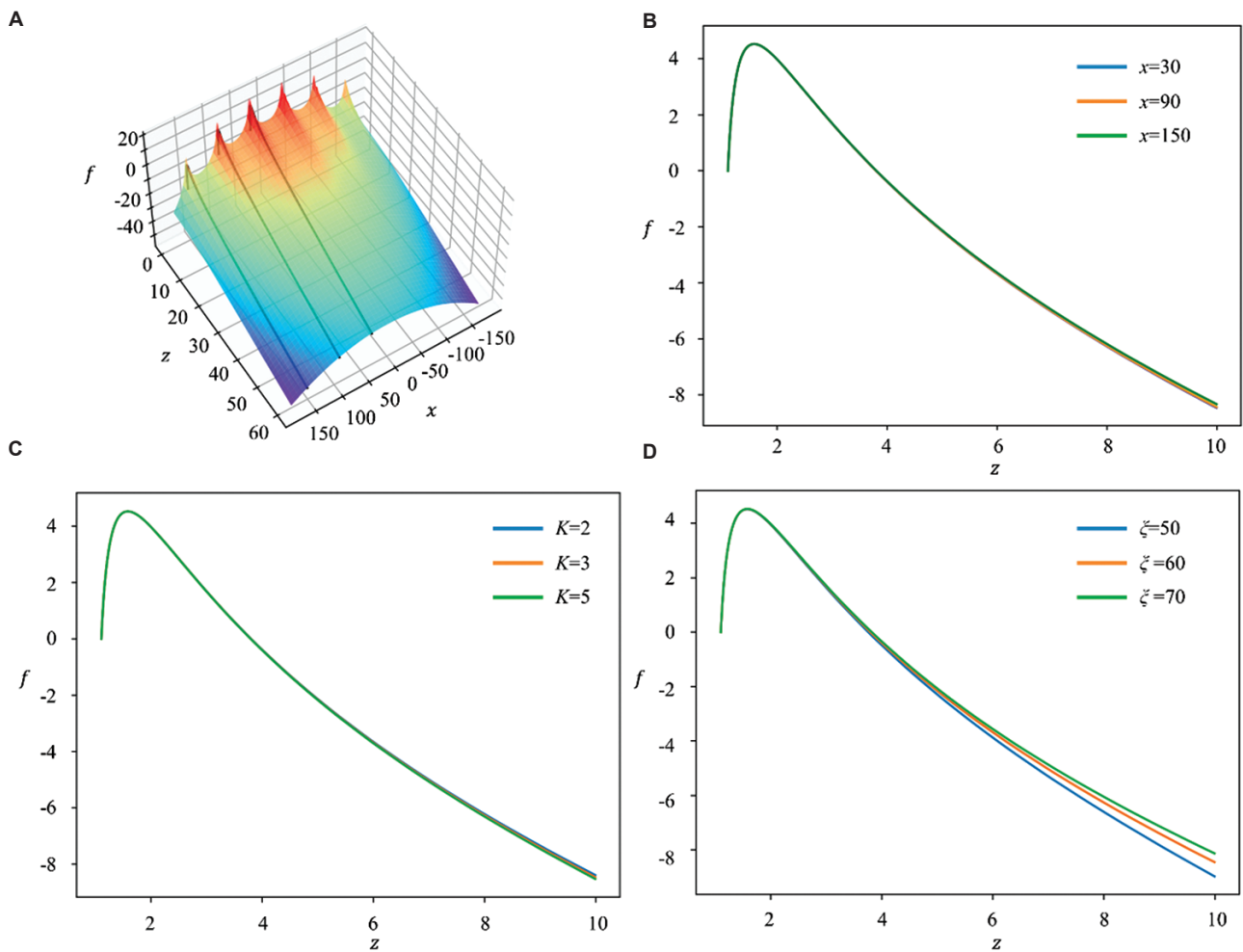
Figure S3. Effects of different parameters on vertical energy variation. (A) Schematic of characteristic surface and vertical characteristic curves. Black curves show the vertical characteristic curves at $x = 0.5\xi$, 1.5ξ, and 2.5ξ, which correspond to the prescribed locations and are shown for comparison in (B). (C) and (D) show the effect of K and ξ on the vertical characteristic curves at $x = 0.5\xi$. $\alpha = \beta = 3$, $\eta = 1$, $\xi = 60$ for (C), and $K = 3$ for (D).

Supplementary Table

Table S1. Parameters for modes of evolution in Figure S1.

Parameter	β	ξ	η	$z1$	$z2$	$z3$
Mode 3	3	5	1	5	1.8	1.1
Mode 4	3	15	0.1	15	3	1.5
Mode 5	3	3	1	3	1.5	1.1
Mode 6	3	2	0.1	2	1.5	1.1
Mode 7	0.1	2	0.1	2	1.5	1.1