Supporting Information

In-Situ Phase-Changeable 2D MXene/Zein Bio-injection for Shear Wave Elastography-Guided Tumor Ablation in NIR-II Bio-window

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Experimental details

1.1. Photothermal Performance of Nb_2C/Zein Bio-implant. Photothermal performance of Nb_2C/Zein bio-implant was measured in a 96-well culture plate containing Nb_2C/Zein implant with different initial Nb_2C concentrations. Because the loss of Nb_2C is negligible during the liquid-solid phase transition, we consider that the concentration of Nb_2C in the implant is its concentration in solution.NIR laser 1064 nm laser irradiation was enforced on the implant. The dynamic temperature vatiaiton profiles and thermal images at the irradiation site were scanned on an infrared thermal imaging instrument (FLIRTM A325SC camera, USA) at different time points.

1.2. *In Vitro* Cytotoxicity Assay. Murine breast cancer 4T1 cell line and L929 cell line were cultured at 37 °C under 5% CO_2 in Dulbecco's Modified Eagle's Medium or RPMI-1640 medium containing with 10% fetal bovine serum (FBS), and 1% penicillin/streptomycin in a humidified incubator. Cells were generally seeded in cell culture flask and allowed to adhere for 24 h, and then they were harvested by treatment with 0.25% trypsin-EDTA solution. *In vitro* cytotoxicity of Nb_2C/Zein bio-implant was evaluated by a standard CCK-8 viability assay of 4T1

cells and L929 cells. Typically, the cells were seeded in 96-well culture plates at a density of 8 $\times 10^3$ cells/well in DMEM or RPMI-1640 medium supplemented with 10% FBS and 1% penicillin-streptomycin at 37 °C and 5% CO_2 for 24 h to allow the cells to adhere. Then, the above-mentioned culture medium was replaced with fresh culture medium. 50 μL Nb_2C/Zein bio-injection was injected into 5 mL saline and the formed solid Nb_2C/Zein bio-implant remained in saline overnight to allow the solvent ethanol diffused thoroughly. The bio-implant was then transferred into the 96-well cell culture plate. After another 24 h or 48 h incubation, implants were discarded and the standard CCK-8 assay was used to evaluate the cell viabilities using the control group as a reference.

1.3. In Vivo Toxicity Assay. All animal experiments were in agreement with the guidelines of the Regional Ethics Committee for Animal Experiments and the care regulations approved by the administrative committee of laboratory animals of Shanghai Tenth People's Hospital. Healthy female Kunming mice (~ 18 g) were obtained and raised at Laboratory Animal Center, Shanghai Tenth People's Hospital. Kunming mice were divided into two groups: (1) control group, (2) Nb_2C/Zein (50 μL Nb_2C oleosol). The histological, haematological and blood biochemical indexes were collected at some certain time intervals (i.e., 1, 7 and 28 days) after subcutaneously administration. Serum biochemistry parameters including AST, ALT, ALP, Crea and urea of blood supernatant (harvest by centrifugation) were recorded using Beckman Coulter Unicel DxC 800 automatic biochemical analyzer. Routine blood test including WBC, RBC, HGB, HCT, MCH, MCHC, PLT and MCV were measured on Sysmex XS-800i automated hematology analyzer. Then, the major organs (heart, liver, spleen, lung, and kidney) were sectioned into

slices and stained with H&E for histological analysis.

Supplementary figures

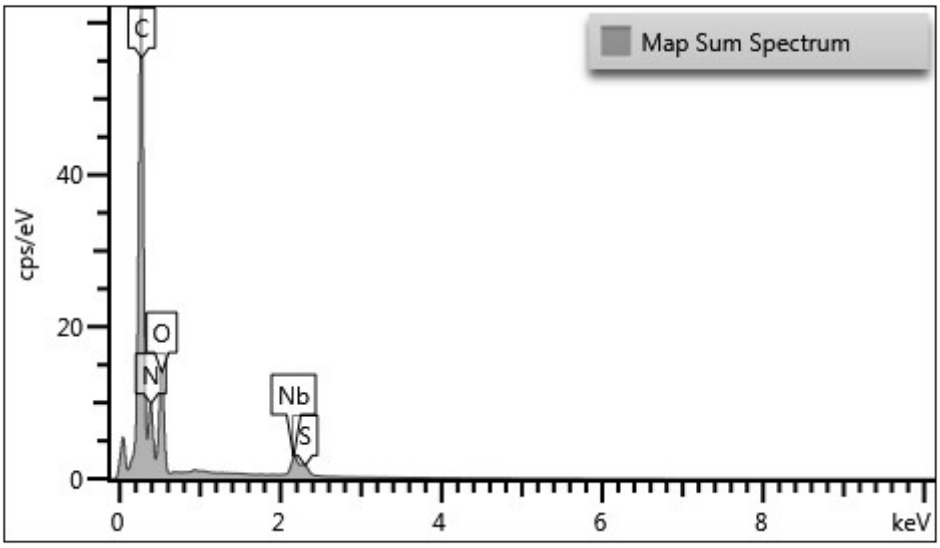

Figure S1. EDX spectrum of Nb_2C/Zein implant.

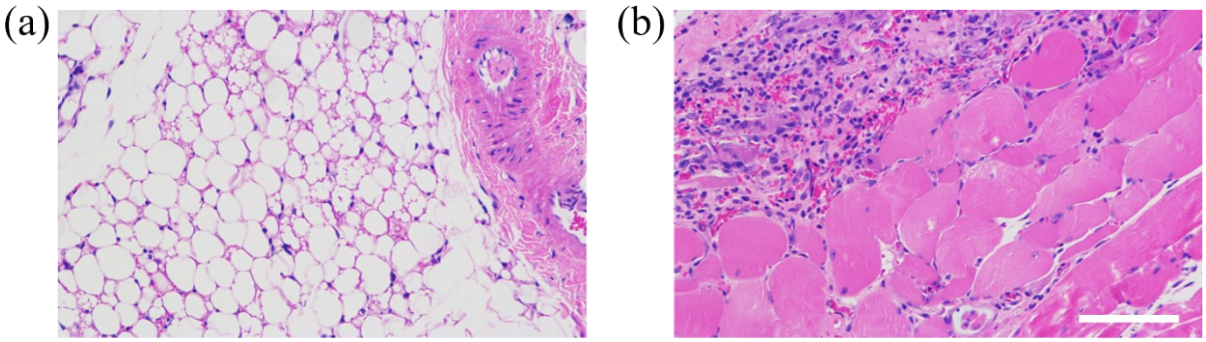

Figure S2. H&E staining of the subcutaneous tissues surrounding the injection site after 28 days of implantation (scale bars: 100 μm).

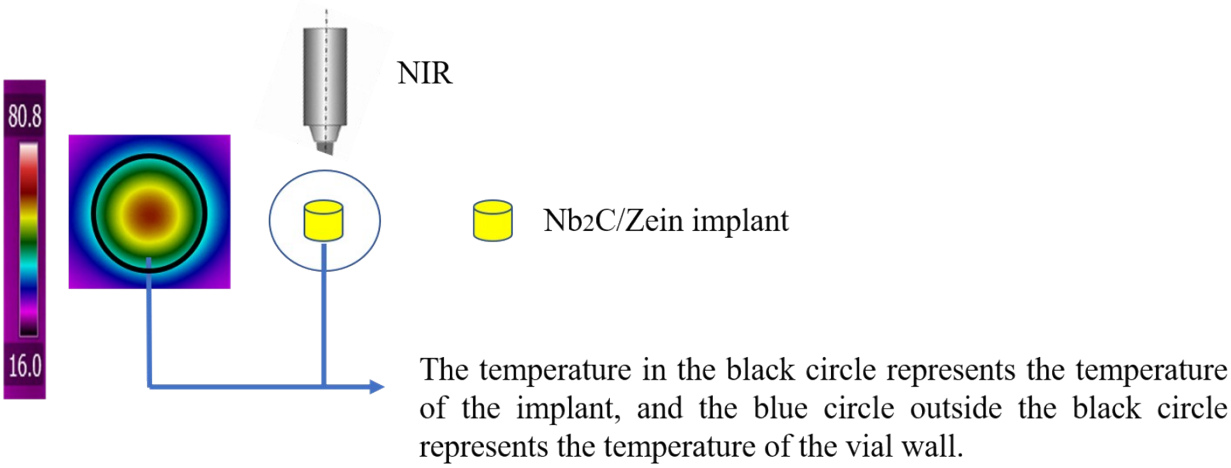

Figure S3. Schematic illustration of the photothermal-evaluation procedure of Nb_2C/Zein implant.