Supporting Information

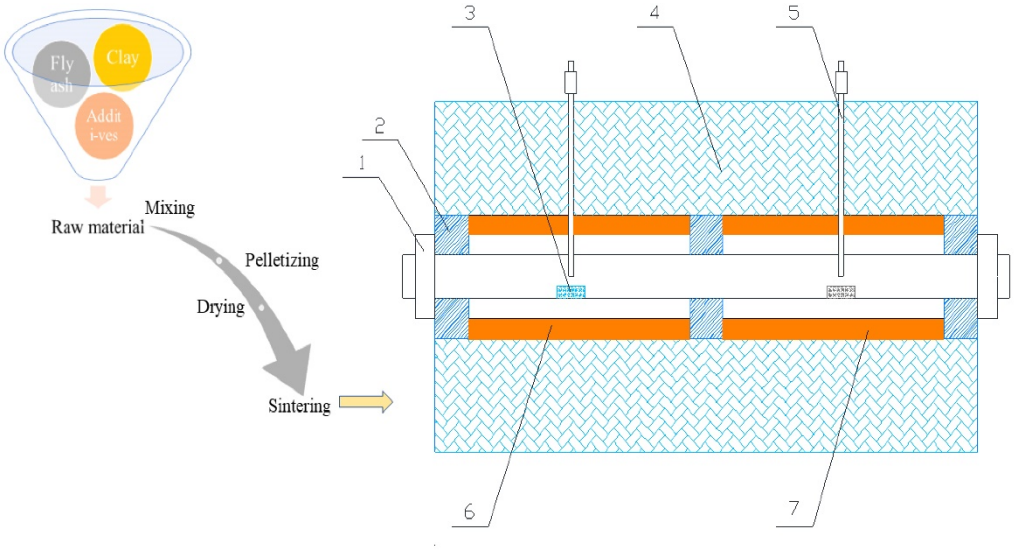
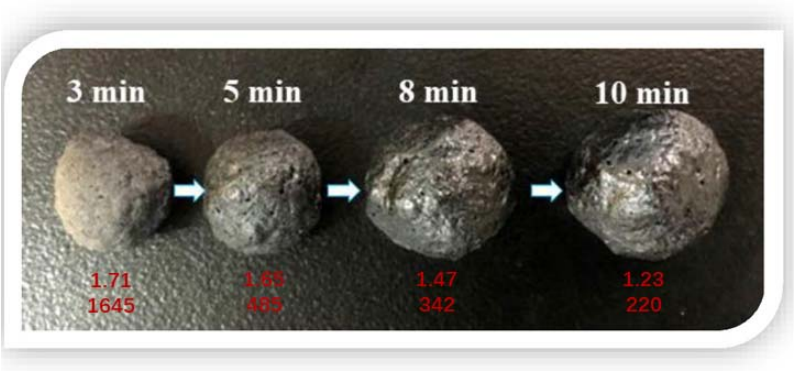


Fig. S1. Preparation process of ceramsite

(1-Movable foam corundum board, 2-Foam corundum board, 3-Corundum boat, 4-Fireclay brick, 5-Thermocouple,

6-Preheating heating zone, 7-Sintering heating zone)



Particle density(g/cm^3)
Compressive strength(N/P)

Fig. S2. The surface morphologies of ceramsite at different sintering time

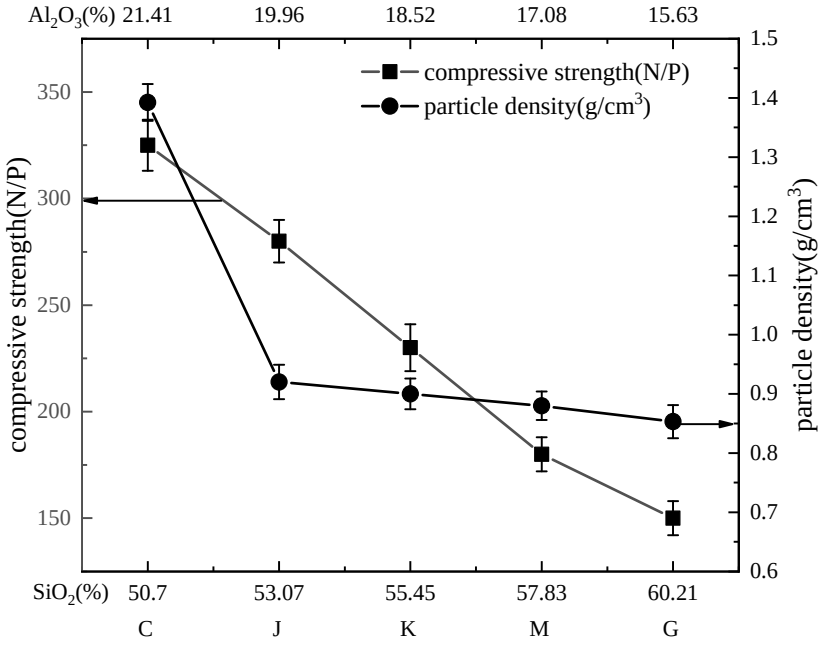


Fig. S3. Compressive strength and particle density change under different components (preheating temperature and time= 800 ℃ and 5 min, sintering temperature and time= 1220 °C and 10 min)

Table S 1 The chemical composition of the materials (%)

material	SiO_2	Al_2O_3	CaO	MgO	K_2O	TFe
fly ash	51.0	17.6	14.6	3.00	1.01	5.60
kaolin	40.44	34.23	0.16	0.07	0.54	0.47
diatomite	88	5.36	0.38	1.64	0.27	2.01
perlite	73.12	17.44	0.79	0.21	4.31	1.23
zeolite	62.87	13.46	2.71	2.78	2.38	1.08

Table 2S The component content under different proportions of fly ash, kaolin, and diatomite (wt.%)

Ceramsite	Fly ash	kaolin	diatomite	SiO_2	Al_2O_3	Flux
A	60	40		48.13	24.61	17.38
B	70	30		49.41	23.01	19.52
C	80	20		50.70	21.41	21.65
D	90	10		51.98	19.80	23.79
E	100			53.26	18.20	25.93
F	90		10	56.73	16.92	23.67
G	80		20	60.21	15.63	21.40
H	70		30	63.68	14.35	19.14
I	60		40	67.16	13.06	16.88
C	80	20	0	50.70	21.41	21.65
J	80	15	5	53.07	19.96	21.59
K	80	10	10	55.45	18.52	21.53
M	80	5	15	57.83	17.08	21.47
G	80	0	20	60.21	15.63	21.40