F tL tL tL atL tL a a a

P. Da [a]

[illegible] a a [illegible] . T [illegible] -
[illegible] a [illegible] . I
S Pb a [illegible] , Pb [illegible] a [illegible] -
[illegible] (165 °C). [illegible]
[illegible] b [illegible] -
[illegible] a [illegible] b [illegible] a [illegible] Pb [illegible] a [illegible] , a [illegible] S
[illegible] a a [illegible] b
Pb [illegible] . I [illegible] S A [illegible] , S [illegible] a [illegible] .
[illegible] a [illegible] S [illegible] A 3S [illegible] -
[illegible] . E [illegible] S [illegible] a a [illegible]
[illegible] a [illegible] a [illegible] a [illegible] a [illegible] .

C [illegible] a [illegible] a [illegible] UBM WLP [illegible] a [illegible] WLP
[illegible] a [illegible]
I [illegible] a [illegible] UBM [illegible] , [illegible]
[illegible] a [illegible] b [illegible] , [illegible] a a [illegible] UBM
a [illegible] . W [illegible] a [illegible] WLP [illegible] , [illegible] -
[illegible] a [illegible] b [illegible] PCB [illegible] .

σ_H tL a tLatL tL a σ_H ¼ ðσ_{xx}þ
σ_{yy} þ σ_{zz}þ/3þ, σ_{xx}, σ_{yy} a σ_{zz} tL tL tL
a tL b tL a tL tL .
I tL a atL tL tL tLa ,tL tL b tL $\vec{J}$,
tL tL tL tL , T, tL ab tL tL atL , a r T,
tL tL atL a tL, tL b btLa tL. T
tL a tL a atL a b a
,

$$r \quad \rho_0 \; 1 þ \alpha ð T \quad T_0 þ$$

tL tL tL PCB (F . 5b). S tL tL tL

F . 8. (a) F tL tL tL -b A a B; (b) tL A (tL b 1 a 2); ( ) tLa A; ( ) tL B (tL b 3 a 4) a ( ) tLa B.

A tL a tLa a b tL tL tL C tLa tLtL a tL PCB , tL a tL a 1.7 a ( ) a tLtL tL C tLa tL . T tL b tL a tL tL tL tL . T a b tLtL tL tL tL tL tL tL 50 °C, tL b a tL tLtLa b tL tL tL tL a a b tLa . T tL tLtLa - tL 20 W/ ² °C.

T tL tL a a tL S A C b a tL Tab 1 [3,9 14] E_A a tL tL , Z - tL a b , D_0 - tL, Q tL - tLa tL, ρ_0 tL a tL a tL tL , α tL tL - tL tLa , Ω tL , B tL a tLa tL K_B 1.380662 23 tL tL a e 1.60219 19, a tL tL tL T_0 303.

T a a tL a tL a tL a tL Tab 2. T tL a tL tL tL PCB a a a tL b a

Tab e 1
E tL tL ba a a tL [3,9 14].

Pa a tL	U tL	Va
E_A	V	0.8
Z		23
D_0	²/	0.027
Q	V	0.0094
ρ_0	Ω	13.3 8
α	1/K	2.8 3
Ω	³/ tL	2.72 29

Tab e 2
Ma tL a tL a a a .

Ma tL a	Ma tL a tL		
	S tL (J/ K)	T a tL tL (W/ K)	E tL a tL tL (Ω)
PCB		1.7	1 10
S (SAC)	219	57.26	13.3 8(1 + 2 3ΔT)
S		150	4.4
C	385.2	393	1.58 8(1 + 4.3 3ΔT)
E	2185	1.2	1 17

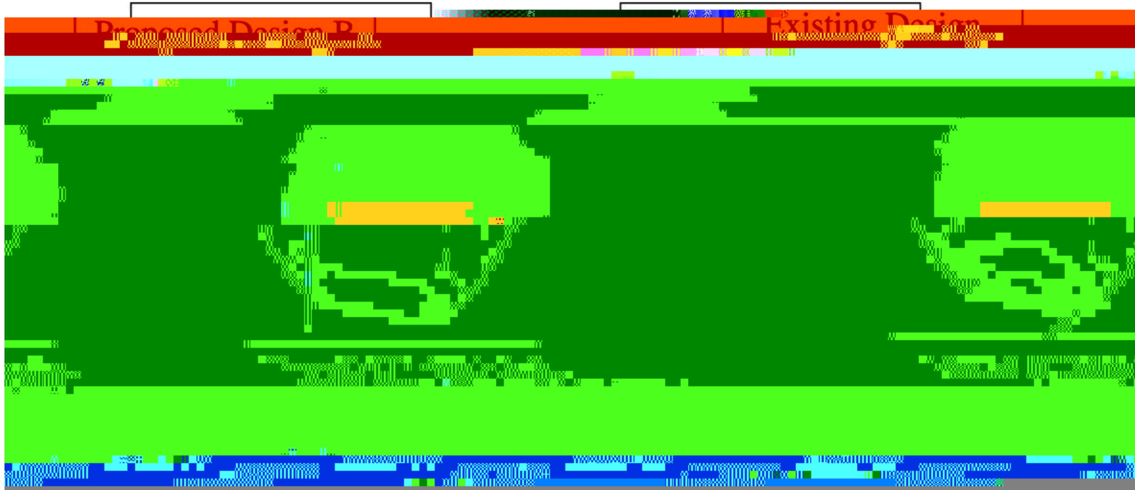
b b tL tL tL a tL tL tL tL tL .

5. Re

5.1. Current density

T tL , tL a a tL a, tL a a tL tL - tL . F . 9 tL tL tL tL b tL tL - b tL tL tL -b tL . F tL , tL a b tL tL tL tL tL a tL tL tL tL tL tL a tL b . S tL a tL tL tL tL - tLa b tL , a F . 2. T tL tL tL tL a tL tL a tL tL a a a tL tL b . T tL b

tL tL tL b tL a a tL tL
0.139 9 A/ 2.
F . 10 tL tL tL tL b tL tL
tL -b tL . S tL tL tL tL
b tL tL tL b ,tL tL tL
a tL tL . T a b a
tL tL tL F . 10



F . 11. C a tL a tL tL tL a B.

Tab e 3

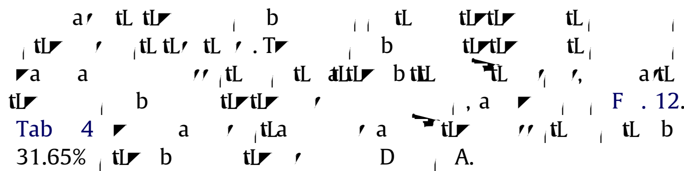
P tLa a tL tL tL a tL tL .

	C tL tL (A/ ^{2})
E tL	0.139 9
P B	0.113 9
% D a	18.71

Tab e 4

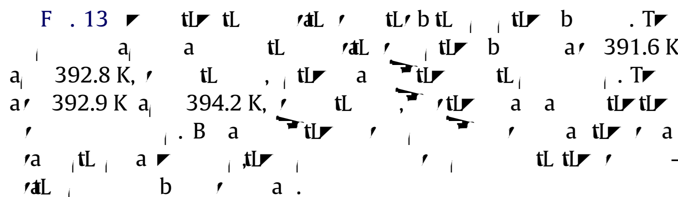
P tLa a tL tL tL 2 b .

	C tL tL (A/ ^{2})
E tL	0.139 9
P A	0.95 8
% D a	31.65



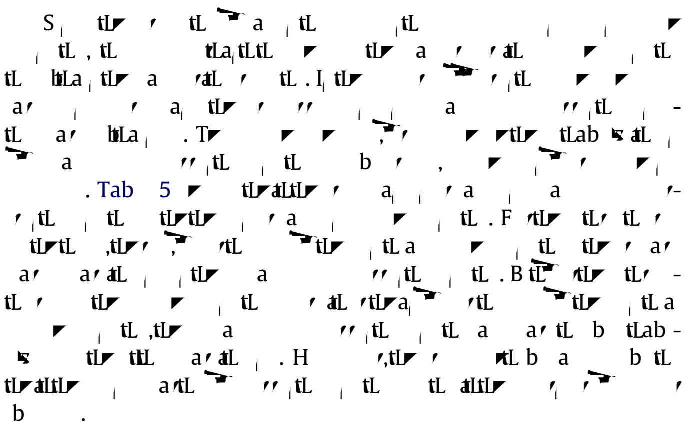
a tL tL b tL tL tL tL . T b tL tL a a tL tL b tL tL a tL tL b tL , a F . 12. Tab 4 a tLa a tL tL b 31.65% tL b tL D A.

5.2. Temperature distribution



F . 13 tL tL tL b tL tL b . T a a tL tL tL b a 391.6 K a 392.8 K, tL , tL a tL tL . T a 392.9 K a 394.2 K, tL , tL a a tL tL . B a tL a tL a a tL a tL tL b a .

5.3. Mesh dependency



S tL tL a tL tL tL , tL tLa tL tL tL a tL tL tL bLa tL a tL tL . I tL tL a a tL tL a tL a bLa . T tL tLab tL a tL tL b . Tab 5 tL tL a a tL tL tL tL . F tL tL tL tL tL tL tL tL a tL tL a a tL a tL tL . B tL tL tL tL tL tL tL tL a tL tL tL a a tL b tLab tL tL a tL . H tL tL b a b tL tL tL a tL tL tL tL b .

F . 12. C a tL tL tL tL tL tL b , tL tL tL a tL tL -b A (2 b).

5.4. Divergence analysis