

»W?L|À¥R?Lαēk^{ao}-ā'' s

«J?•-Ā ?• ±¶Sō÷?• ?• Ûç

°K-njG?2?2»W?2|À^{ao}-S?2|A-ā'' 𐄂 𐄂W?2|À¥R?n?2?2μ 𐄂 𐄂𐄂ā𐄂𐄂𐄂2¶HjA'ē¥X°MαĀRα 𐄂 Lú
¥R?Dα 𐄂j|A|}®i ± 𐄂 F 𐄂D®i «e'°jC

?i?i?i|G»W?i|ÀjF¥R?i|F|ā𐄂 𐄂

α 𐄂 ¥

?'»Ä»W?'|À¥ñα 𐄂 ä 𐄂y|''¥»S 𐄂A®e¶qαjAÉ2®æS C 𐄂Ó±ö 𐄂 𐄂'ax^{ao}'' ¥ĤjC|ý-0jA-Y'' ¥Ĥ
α 𐄂FjA'' 𐄂F°R?Fαj𐄂 𐄂Fμ 𐄂C¼v?F?F»Ä»W?F|À?F°R^{ao}|] -Ā«Ü|hjA|Ó^{ao}¥Ĥ¥ĴÜ^{ao}¥R?Fα 𐄂j|A-ā|³
®Ä°jPÜ»W?Ü|À^{ao}'' ¥Ĥ?Ü°RjC

-ā'' 𐄂p?bjG?bjÀ¥R?b?bjμ 𐄂p?bjÀ?b°R¼v?b³| αjA°ñ?b?bjμ 𐄂°¼v?b?bjμ 𐄂Cα jN-0?bjA?bαj
|h?'^{ao}»W?'|Àα 𐄂Ó¥ĤS 𐄂°jA|Ó-0'' ¥RS ¥^{ao}jC¥ñ|'¥i?'|Aα 𐄂' |n^{ao}¥R?'¼1?' »W?'|À^{ao}'' ¥Ĥ?'
°R'' 𐄂3?#'' 𐄂#-«^{ao}S ¥ĤjC

1 »W?'|À¥R?'^{2z?}' ° 𐄂'

α 𐄂W@?x60|~¥Nα 𐄂ĀjA-ü?x-i?x®a?x'μx?xα 𐄂W?x|À^{ao}¥R?x?xμ 𐄂 𐄂 𐄂j|q^{ao}?x?x-ā'' 𐄂A|}
'ē¥Xα 𐄂H³|S 𐄂XÉa²v?ü«e'ē^{ao}jA»W?ü|À¥i ± 𐄂 𐄂°¥R?ü| ±üjA|p?ü1°0¥ÜjC?ü?ü^ai°újA|p^aG¥R?ü
?"-y«ö?"?"| ±?"?" α 𐄂A'N¥i ¥Hαj𐄂 𐄂μ 𐄂R?"?"?"|A|}¥B?"?"|À^{ao}®e¶q°M?"°Rα 𐄂?|"¼v?"|C-i
?Gα 𐄂 𐄂G?G| ±G?G?G³|'' ¥R?G| ±GjA?G|Ó³p°wα 𐄂 𐄂t¥R?Gα ēk^{ao}-ā'' 𐄂 𐄂V[1jA2]jC

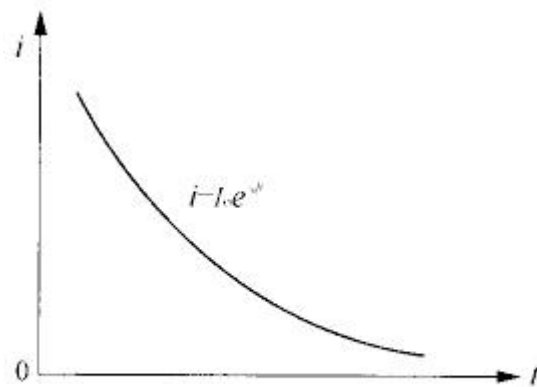


图 1 最佳充电曲线

¥ñ?Ži¥i ¥H-Y¥XjG^ai°i ¥R?ŽŽ-y«ÜαjA|ý-0° PŽ«ÜS 𐄂C¥D-n-i|]-0¥R?ŽŽμ 𐄂 𐄂Ž¥Ĥ α 𐄂Fāα 𐄂
?0¶HjC|b± KĒ|j »W?0|À¥R?0?0μ 𐄂 𐄂A?0³j?0¥Ĥ®ñÉa°M?0ÉajA?0®ñÉaα 𐄂Éa³Qα 𐄂P0S |]-?0jA«K° i
?|b¥Ĵ|ā^{ao}j|¥Ĵ|ā^{ao}? ¥Ĥ®ñÉaj^jA'' 𐄂 |À? ³j? α 𐄂[αjA? |À? «xα 𐄂 𐄂A|P? ? α 𐄂 𐄂Ĵ|ā^{ao}
^{ao}- ±ejA^ai?e?e^ayα 𐄂 𐄂A¥X?e°0?e^{ao}|ā𐄂 𐄂e¶HjC

»W?ó|À-0¥i ° 𐄂°jC'' 𐄂ñ?óα ¥R?ó^{ao}α 𐄂óα 𐄂Pó|j|pα 𐄂G

Pb02j|Pbj|2H2S042j- 𐄂PbS04j|2H20 |j1j^

«Ü?Lµ MÄYR?L?Lµ MÖñ?L?Lµ 6 3L° 6 P; C¥i° P;Lµ {N-0?Lα 0L^{ao}¥-¿Ä?Lµ {A?L«0»Ü?L
|Ä-à?B?B«ü|b¥-¿Ä?B?Bα S WR?B; A¥²?B?B¶q'' Pq?B?B; Ä^{ao}?B-yα p@ C²z. Qß¥ó-0¥~¥[
?q?qµ ¥ 2q|Ä¥»'' æº?q?q?qi C|ý-0; A?q?q^{ai}©ü; A»W?q|Ä¥R?q?qi A¥~¥[?q?q¥²?q¼Wα j' ¼@w?q
-Éα þæ, |Ó? ? ? -Éα \$]? ? lãS æ; A. 3G? «xµ ¥Uíú|] Ä^{ao}©t? |Ó|bα fPµ {xα ¶W? α 6W?
|Ä^{ao}¥-¿Ä?~?~—É; C|bα æ-α P-α pA?-íú?~?~¶W?~?~α 0-¥-¿Ä-É^{ao}?-¶H; A 'N-0|ãα æ-¶H; C

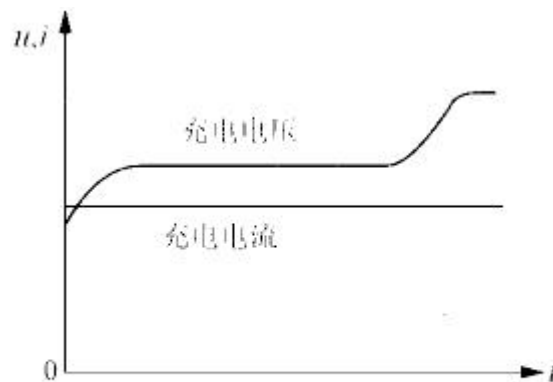


图 2 恒流充电曲线

α æë?n?nj A?n¥í lãα æ¶¶H; 33?nα è±^{ao}-í |] j C

1; ^?¹©i lãα æR?¹?¹µ 6 p¥¿?¹ÖÄα |V?¹ lã?¹²¼; C|bÖÄα P¹²¼?¹µ 6 α æi ÄxS Ka'' ü ¼@w
aoayα QA?b?b?b?i ?bay; C?bα S 3A?b?b?b?ay; A¥~¥[?b?b 'N¥²?b?b¥~-l¥[α @w^{ao}?b?b; A¥HS 3A
ayα 6 æ ÖÄα P ²¼; C? ? ? ¥H? aoα 6; ? α æ ? ¹Ö; A¥X? ©Ö? ao? ©i lãα æC? ? ¥R? ? -y«æ
?(¥[α j A?(©i lãα æ(3y|''»W?(|Ä; b¥R?)(µ 6 æº ?(j C

2; ^?r«x lãα ær-y-y?r»W?r|Ä?r; A?r?r«ù¥¿± aoα P; r; A³| 2z. 0º± ?r-0?r lã^{ai}-±^{ao}α P; r«
-ãα P-± ö P-¥R; A¥í |''a«-ãα P-ÖÄ¥h; C?-?α W¥í |''a«©Mα P-a^{ao}?-²³t«x?-?α æ æ æ æ æ—
α P¼³t«x A?¼; Ö³y|'' lã^{ao}ap^{an}?¼ N?¼. 3G?¼«x?¼¥í ?¼α æCα JN-0?¼; A?¼?¼ lã^{ai}-±' ¼ æ. »
²G; A?ä N²G?ä«xα æ-α S ?ä; C?äíú?ä¶H?ä?ä?ä«x lãα æC

3; ^?, α æ, lãα æ, íú lãα æÖNα 2, lãα W, |æ^{ao}?, α æ, α P, ^{ao}3t«x A, ''|Zα 2, lãα W, α P, ?,
^{ao}3t«x³y|''ao; C'' 0p; G?Q|Ä^{ao}?Q lã^{an}?Q«ej A?Q lã^{ai}-±Q|³?Q?Q²ü; A'' ap^{an}. 3G?Q|³¥¿?Q²ü; A
?rál ?rα ¥-¿Ä?r?r; C^{an}?r?r; A¥BS Y³?rα P; r^{an}?r¥~?r, ô; C?r lã^{ai}-±r?r²ü?rα 0A|Ó^a?r. »N
^{ao}©ñα æ P-?~æ-ºCMej De Me; í; Aα Èαα P-?¥R?-lã^{ai}-±-α Pº?-α 0A?-lã^{ai}-±-?~?~?~?~
¥í?¼α æC?¼íú^{ai}-±¼?¼²ü?¼α 0º?¼?¼P?¼^a-?¼α æ¼α ÖÄ?¼?¼ lã; A^a-?¼ÖÄα Me; í?¼α j 3G; A¥[
³tMej De Me; íα PÄ?Ä; æ; C?Ä|³α æÄ?Ä'' 6A?Ä'' i 3º?Ä?Ä¥-¿Ä; C|ýÉÖ^{an}?Ä«e-Üα pA?Ä lã^{ai}-±0
? ? ? ²ü? ¥0? α æ FAEÖ|¹? ? ao? lã? ? ? ¥¿; Cα JN-0? α æ lãα æ ? ? ° pA? |Ó? -«ay
?Xα æ¿± ao¥R?X?X-y; C|P²z; A?X; A¥¿ lã^{an}?X?X; A?X lã^{ai}-±0?X¥¿?X²ü?X¥0?Xα 0A?X lã?X?X?X
?ç; C

?73íú lãα æ7¶H³E-0?7?7¥R?7?7-y^{ao}¼Wα j|Ó?7-«j C

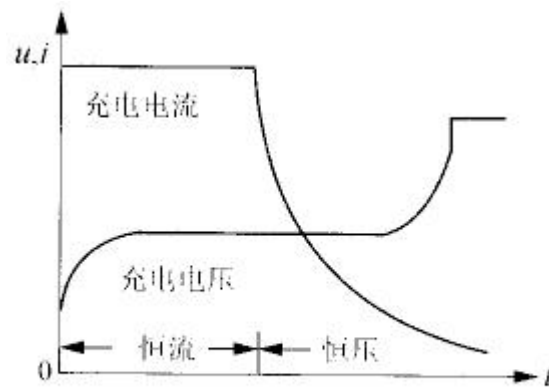


图 3 二阶段法曲线

2 ¥R?Â ¤ êk^{ao¬ã} s

$$2.1 \pm 0.3 \text{ k}$$

±? ¥R? " k×0" Du1940|~«e? ? x 0 a0? ? ak? ? ? a0jC" x x μ 0W a0 N-0" |w° 0 p
 ?>?>?" jG¥R?>?>-y|w° 0>j A x 0>¶W?>»W?>|À«Y¥R?>a0|w?>?>j C?>?>x W A ± ?>¥R?>a03t«x3Q
 »W?c|A|b¥R?c?cμ { x?c x E M E a E ^ a0?c ¥ | 0 - - " j C?c?c?c ¶ H?c»W?c|À¥R?c©0¥2?c a03 j μ 0 c?c
 " 3-«-n. N j C

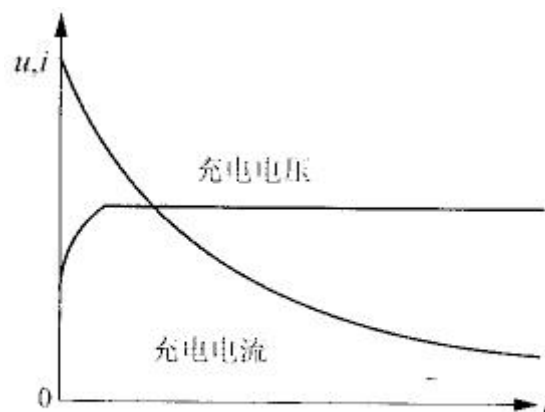


图4 恒压充电法曲线

α @ë?X?X; A± ?X¥R?X| ³¥Hα ßí ú; C

2.1.1 $\neg y \neq R?i^a k$

ūŪ-yŕ?•ak-0ŕĭ?•%aŕ?•?•m?•ŕX?•?•©ĬSŕŕ•Ē0»W?•ĬÀĭê?•?•ay^{ao}αĕkĬA«0«ùŕ?•?•-y
 ?Ē«xαĒĒ^{ao}ŕ?ĒαĕkĬAĬp?Ē2©0ŕŪĬC±±ŕĕk?Ē?ĒĬAĬyŕNα²ĒĬÀ^{ao}ŕĬ±ĭŪĒ-y-àαθ0?Ē?Ēŕ?Ē
 ?μŕ^o?ŕæĬ0³v?αŪ^{ao}ĬAŕŕŕ?ĬZĬĬAŕ?ŕ-yĬhŕĬα²ŕNαŕA?ŕĬĒĒĒĬAŕŕŕXĒĒ-ĒĬA
 ĬĬĬĬA±ŕŕĬŕ-ŕŕ?ŕakĬC

2.1.2 $\neg q \vee R$

$$[1 \times ek] \neg A \times G \neg q \neq R? \quad a_k \odot M \times T \neg q \neq R? \quad a_k | C$$

2j ^ α P → q ¥ R ? - a k | b ¥ R ? - ? - © | © M ? - S @ - a ö ¥ Î ú Ú ? - y ¥ R ? - | A α x ¥ Î ú Ú ? - ? - ¥ R ? - | C ? - ? - y ° P -
 · · P) © W - Ê ?) | A ¥ Î ² Ä α @ - q ?) ? · · F Ä α P - q | C ?) Í ú α ê k ¥ | ¥ H ?) ¥ X Ê a ¶ q ?) · · P l α @ A | ý S @) α @ ú S 0
 3 t ¥ R ? » α ê k · · ¥ Î | A · · ü ð © W a ° - - · · Î C

The graph shows a periodic current i over time t . The current is zero for most of the time, but it has a constant positive value for a duration T . This duration T is the period of the current.

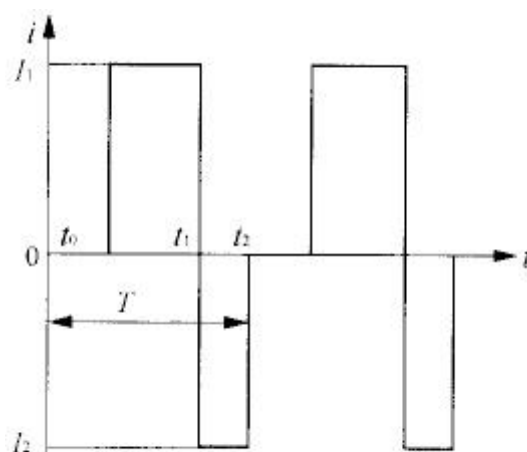


图 6 Reflex™ 快速充电法

2.2.1 $\frac{1}{2} \frac{d}{dt} \int_{\mathbb{R}^n} |u|^2 dx = \int_{\mathbb{R}^n} u \Delta u dx$

?K!ú¥R?K^kαPKjı̇`»W?K|Ä©T|³a°¥R?K±jüøv;A|Ó¥B^-à?K'£°§W?K|Ä¥R?K±jüøv;A?K|Ó
¥'-)α\$W?¼|Ä«ü?¼¥R?¼±jüüşz¼^{a°}--ı̇ı̇A?¼αj0»W?¼|Ä¥R?¼z?¼^{a°}. §¼®ı̇jC

? ? ¥R? ¤¢¡-°¥y-0¥Í? ? ? -y? ? |À¥R? ¡AµMΖ? ? |À° ¥R¤@q? ? ¡A|p|'¹~? ¡A|p
?, 5°0¥Üj C¥R?, ?, ?, " ¢W?, |À¥R?, ?, ¶q¡ A|Ó?, · ºÁ" ¢W?, |À?, ¤Æ, ¤Ð, ?, ¥í^{aoo}nÉa©M?, Éa|³?
?Q-«· ¤FX|Ó³QS ||±¥Á" PQ©t!â¤ÆM?Q©i!â¤ÆUµ MÓµ Ma±ö Pø° fAQ|Ó?Q?Q¤ ¢W?Q|À^{ao}
?v?v¡ Á" ¤¢ @v^{ao}üU-y¥R?v-à?vS Ø[?vS Qa?v|æj Á" ¢W?v|À¥i ¥HS ||-S øh^{ao}?v¶qj C?v· ?v?v
" ¢W?> |À|³?>¥R¤ Á°¤ Ð?>?>? j A?>¤ ¤ FREÁ¶qj A'£° ¤ ¢W?> |À^{ao}¥R?>?>-y± µ øv[5]j C

2.2.2 ReflexTMS Öt¥R?âªk

?, IúS Ø, -0-ü?, ^{ao}α@, ?, S Ø Ø, jAY|¥D-n-±, ^{ao}¥R?, ?, ¶H-0?, ?, ?, |Àj C¥N̄α ¥| ^{ao}¥Î α F S
«-^{ao}¥R?Qα êk| A₂N̄?Qα P?Q?Q| ^A^{ao}?Q?Q®Á?Qj A|]] ' | Aα jα j° S Ø FW?Q| ^A^{ao}S Øt¥R?Q^{ao}?Q?Qj C
?v>Á>W?v| ^A^{ao}¥R?v α êk©M?v¥R?v?vv^{ao}?v?v α êkÉO?v?v?v| ^À|³«Üα j°α £Pj A|y¥|?vα S¥i ¥H
-Üα =É?> [3]j C

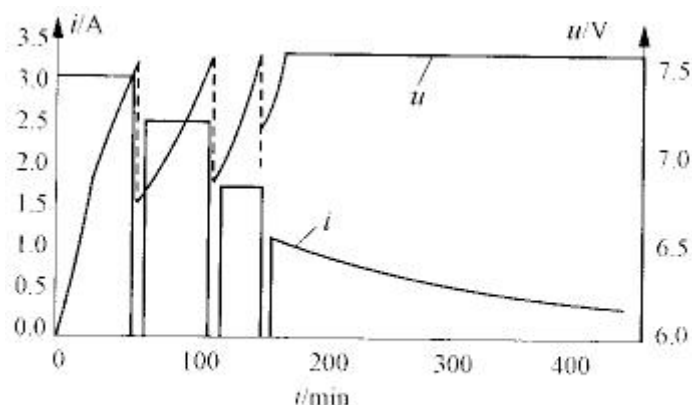


图 7 变电流间歇充电曲线

|p?»6©0ÿÜ;AReflexTMYR?»ak^{ao}α@?α§@P´Á¥]-AY¿;|V¥R?»?»?»»;Aα|VÀp?»©ñ?»?»?»»;A°±
¥R?0«ù3?0?0-q[3]jC

2.2.3 ?L?L-y?L· ¥R?L^{ak}

?qĭ ú¥R?q₂ ěk«0¥B|bùÚ-y¥R?q^oM?q?q¥R?q^{ao} 0q₂ W A|p?q7^o0¥Üj C[·] äS?q-0?qùÚ-y¥R?q-q S ĭ

?)--?)?)?)-y?)· ¥R?)-qj C¥R?)«e¹Á^{ao}|U-q^{ao}ŷĪ(?)?)-y?)· ¥R?)^{ao} ěkj A«0?)¥[₂ ¥R?) ?»-y|A?»± 0»₂ ßj₂ ě R?»ŷŷqj C¥R?»|Z¹Á^{ao}ŷĪ^ow?»?»¥R?»-qj A?»± 0»¥R?»ŷŷqj A?»?»|Ä«ĭ Ī[·]|ÜS¹ ¥b¥R?N?Nj C³q?N?N·² ¥Rj A[·] ŷW?Nj Ä?N ě R?N ě P?N?NŷĪ^{ao}ñÉa^oM?NÉa|³?N?N-«[·] \$ ĄX|Ó³Q S ĩ[·] ± ¥A[·] Pá^otĭ ā ě R?M?á^oi ĭ ā ě R?U_μ MÓ_μ Ma± ö P^o° fA?á|Ó?á?á ě R?W?á|Ä^{ao}?á?áj A[·] ĭ ě R?á^{ao}üÚ -y¥R?s⁻ā?S S ĩ[?s S Qa?s|æj A[·] ŷW?s|Ä^oi ¥H S ĩ[·] S φh^{ao}?sŷŷq[4]j C

2.2.4 ?~?~?~?~· ¥R?~^{ak}

|b?½?½-y?½· ¥R?½^{ak}^{ao} 0½ ě W \$³ ě H E ¥ X ě P½?½?½?½· ¥R?½^{ak}j A|p?½8^o0¥Üj CÉ0?½?½-y?½[·] ¥R?N ě k ě f P ě S N|b ě z Ä ě R?N-q^{ao} ě f O?N· 0Ü-yj A|Ó-0?N· 0Ü?Nj C

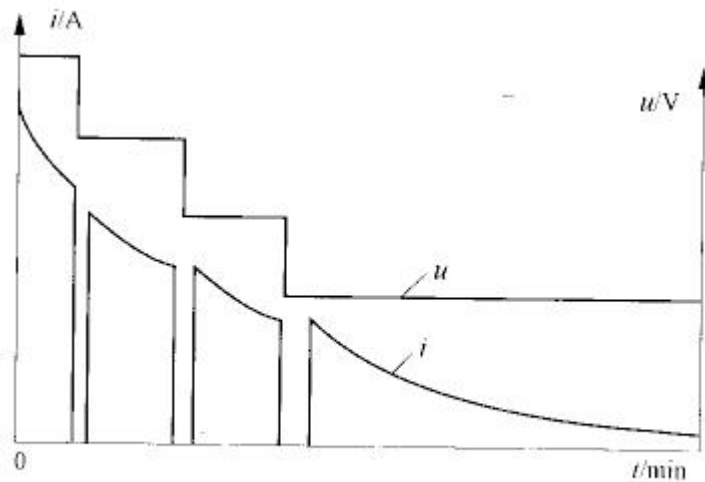


图 8 变电压间歇充电曲线

ě R?-?-7^oM?-8j A^oi ¥H-ŷ¥Xj G?-8 S ĩ[²Ä|X³] ĭ[·] ¥R?-^{ao}¥R?-|±?-j C|b[·] 0-üÚ?-?-¥R?-?-qj A ¥N ě₂ 0üÚ?0¥R?0j A¥R?0?0-y|Ü_μ M^o· 0ü?0?0«B ě W^oj A²Ä|X?0|Ä?0-y¥i ± ĭ 0v?0?0¥R?0^{ao}?0|æ³v? ě W^{ao}-S?÷[4]j C

2.2.5 ?B?B?B?B?B-y^{ai}®ö|j ?B· ¥Ĵ?B¹s?B?B S 0t¥R?B^{ak}

?|X? ? ¥R? ^{ak}j BReflexTMS 0t¥R? ^{ak}j B? ? -y?· ¥R? ^{ak} ě P ? ? ?· ¥R? ^{ak}^{ao}É- ?b|A?b?b?b?b?b-y^{ai}®ö|j ¥Ĵ?b¹s?b?b?b· S 0t¥R?b^{ak}± ö P^ob^oi ?bŷĪj C?b?b¥R?b^{ak}¥R?b?b₂ö^{ao} ± ± ě R?@ē|³?ŷĪúj G

1j ^?9?9?9-y^{ao} Ī-È¥i ?9j A|ÓPWWj]?9?9¥R^oñ?9?9?9^opj ^«H?9^{ao}?9²v-0^oT^ow^{ao}j F

2j ^?Ī?Ī?Ī-y Ī-È^oT^ow ě R?Īj APWW«H?Ī^{ao}?Ī²v¥i ?Īj C

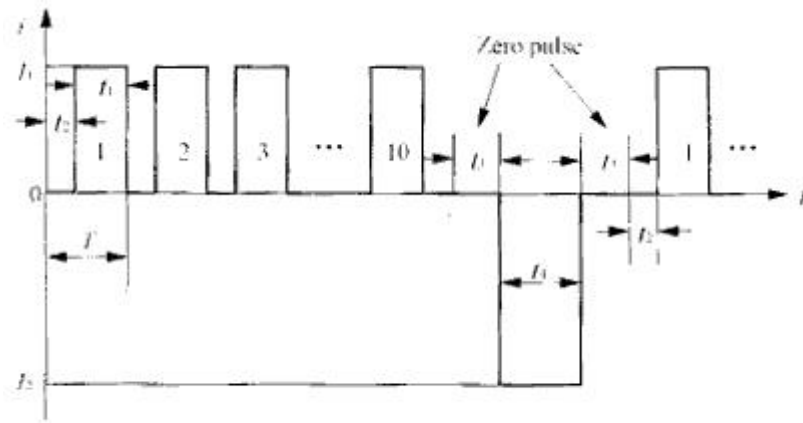


图 9 波浪式间歇正负零脉冲快速充电

$\alpha_1 \alpha_2 \alpha_3 \alpha_4 \alpha_5 \alpha_6 \alpha_7 \alpha_8 \alpha_9 \alpha_{10} \alpha_{11} \alpha_{12} \alpha_{13} \alpha_{14} \alpha_{15} \alpha_{16} \alpha_{17} \alpha_{18} \alpha_{19} \alpha_{20} \alpha_{21} \alpha_{22} \alpha_{23} \alpha_{24} \alpha_{25} \alpha_{26} \alpha_{27} \alpha_{28} \alpha_{29} \alpha_{30} \alpha_{31} \alpha_{32} \alpha_{33} \alpha_{34} \alpha_{35} \alpha_{36} \alpha_{37} \alpha_{38} \alpha_{39} \alpha_{40} \alpha_{41} \alpha_{42} \alpha_{43} \alpha_{44} \alpha_{45} \alpha_{46} \alpha_{47} \alpha_{48} \alpha_{49} \alpha_{50} \alpha_{51} \alpha_{52} \alpha_{53} \alpha_{54} \alpha_{55} \alpha_{56} \alpha_{57} \alpha_{58} \alpha_{59} \alpha_{60} \alpha_{61} \alpha_{62} \alpha_{63} \alpha_{64} \alpha_{65} \alpha_{66} \alpha_{67} \alpha_{68} \alpha_{69} \alpha_{70} \alpha_{71} \alpha_{72} \alpha_{73} \alpha_{74} \alpha_{75} \alpha_{76} \alpha_{77} \alpha_{78} \alpha_{79} \alpha_{80} \alpha_{81} \alpha_{82} \alpha_{83} \alpha_{84} \alpha_{85} \alpha_{86} \alpha_{87} \alpha_{88} \alpha_{89} \alpha_{90} \alpha_{91} \alpha_{92} \alpha_{93} \alpha_{94} \alpha_{95} \alpha_{96} \alpha_{97} \alpha_{98} \alpha_{99} \alpha_{100}$

3 ?ç?ç

$\alpha_1 \alpha_2 \alpha_3 \alpha_4 \alpha_5 \alpha_6 \alpha_7 \alpha_8 \alpha_9 \alpha_{10} \alpha_{11} \alpha_{12} \alpha_{13} \alpha_{14} \alpha_{15} \alpha_{16} \alpha_{17} \alpha_{18} \alpha_{19} \alpha_{20} \alpha_{21} \alpha_{22} \alpha_{23} \alpha_{24} \alpha_{25} \alpha_{26} \alpha_{27} \alpha_{28} \alpha_{29} \alpha_{30} \alpha_{31} \alpha_{32} \alpha_{33} \alpha_{34} \alpha_{35} \alpha_{36} \alpha_{37} \alpha_{38} \alpha_{39} \alpha_{40} \alpha_{41} \alpha_{42} \alpha_{43} \alpha_{44} \alpha_{45} \alpha_{46} \alpha_{47} \alpha_{48} \alpha_{49} \alpha_{50} \alpha_{51} \alpha_{52} \alpha_{53} \alpha_{54} \alpha_{55} \alpha_{56} \alpha_{57} \alpha_{58} \alpha_{59} \alpha_{60} \alpha_{61} \alpha_{62} \alpha_{63} \alpha_{64} \alpha_{65} \alpha_{66} \alpha_{67} \alpha_{68} \alpha_{69} \alpha_{70} \alpha_{71} \alpha_{72} \alpha_{73} \alpha_{74} \alpha_{75} \alpha_{76} \alpha_{77} \alpha_{78} \alpha_{79} \alpha_{80} \alpha_{81} \alpha_{82} \alpha_{83} \alpha_{84} \alpha_{85} \alpha_{86} \alpha_{87} \alpha_{88} \alpha_{89} \alpha_{90} \alpha_{91} \alpha_{92} \alpha_{93} \alpha_{94} \alpha_{95} \alpha_{96} \alpha_{97} \alpha_{98} \alpha_{99} \alpha_{100}$

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