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%% 恒定温度的伏安曲线
clc;clear;close all;
T=30+273.15;q=1.6e-19;
V=0.450:0.005:0.540;
I=[4.500,5.500,6.600,8.000,9.500,11.700,14.300,17.200,20.800,25.200,...
30.500,38.000,44.700,54.500,66.500,78.000,95.000,116.500,143.000];
hold on;
scatter (V,I,'MarkerEdgeColor',[0 .5 .5],...
'MarkerFaceColor','b',...
'LineWidth',1);
f=@(a,K) (a(1)*exp(a(2)*K));%a(1)=I_s,a(2)=q/(K*T)
ahat=nlinfit(V,I,f,[0,0]);
plot(V,f(ahat,V),'g-','LineWidth',1.2);
legend("测量数据","拟合数据",'Location','northwest');
xlabel("正向电压 $V_s$ "); ylabel("正向电流 $I_f$ ");
title("30°\circ C 时该半导体正向导通伏安曲线");
Is=ahat(1);K=q/(ahat(2)*T);
KO=1.38e-23;
eta=abs(K-KO)/K;
str={strcat("反向饱和电流 $I_s$ =",num2str(Is)),strcat("玻尔兹曼常数 $K$ =",num2str(K)),strcat("与公认值误差 $\eta$ =",num2str(eta))};
text(min(V)+0.002,max(I)-50,str);
hold off;
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%% 恒定电流半导体温度特性曲线
clc;clear;close all;
T=[30:5:80]+273.15;q=1.6e-19;
Vup=[0.513 0.501 0.49 0.478 0.467 0.455 0.443 0.433 0.421 0.409 0.398];
Vdown=[0.512 0.501 0.489 0.477 0.466 0.454 0.443 0.432 0.409 0.409 0.398];
V=(Vup+Vdown)/2;
hold on
mdl=fitlm(T,V);
scatter (T,V,'MarkerEdgeColor',[0 .5 .5],...
'MarkerFaceColor','b',...
'LineWidth',1);
a=mdl.Coefficients.Estimate;
f=@(x) a(2)*x+a(1);
fplot(f);
xlabel("半导体温度 $T$ °\circ C"); ylabel("正向电压 $V_f$ (V)");
title("施加50 \mu A时该半导体温度特性曲线");
axis([300,350,0.4,0.52]);
legend("测量数据","拟合数据");
Eg=q*f(0)/(1.6021766208e-19);
str={strcat("灵敏度 $S$ =",num2str(a(2))),strcat("近似禁带宽度 $E_g(0)$ =",num2str(Eg))};
text(305,0.44,str);
hold off
```