Table 4. 1 Fracture energy of aged and re-dried adhesive joints

Adheisve Type	**Joints with gold plating**				
	As-bonded	2 days aging		50 days aging	
	G, J/m^2	Aged, G, J/m^2	Dried, G, J/m^2	Aged, G, J/m^2	Dried, G, J/m^2
ECA1	138	34	136	4	36
ECA2	143	64	102	4.7	6
ECA3	170	46	119	10	10
Adheisve Type	**Joints with copper plating**				
	As-bonded	2 days aging		50 days aging	
	G, J/m^2	Aged, G, J/m^2	Dried, G, J/m^2	Aged, G, J/m^2	Dried, G, J/m^2
ECA1	139	105	136	16	15
ECA2	118	9.8	17.5	27	24
ECA3	159	22	69	13	35

Table 4. 2 Atomic concentration on the fracture surfaces of the as-produced ECA2 bonded joint.

Element	**C**	**O**	**N**	**Ag**
Fracture surface-side 1	73.7 %	16.3 %	2.5 %	6.9 %
Fracture surface-side 2	74.3 %	15.1 %	2.9 %	6.9 %

Table 4. 3 Atomic concentration on the fracture surfaces of the ECA2/Au bonded joint aged for 2 days.

Element	C	O	N	Ag	Au	Ni	Cu
Fracture surface-metal side	52.8 %	16.8 %	5.8 %	3.2 %	17.4 %	2.4 %	1.6 %
Fracture surface-adhesive side	78.1 %	18.3 %	2.6 %	0.1 %	0.1 %	0.9 %	0 %

Table 4. 4 Atomic concentration on the metal side of fractured ECA1/Au, ECA2/Au and ECA3/Au joints aged for 50 days.

Element	C	O	N	Ag	**Au**	**Cu**
ECA1	56.8 %	15.8 %	4.4 %	4.4 %	**17.4 %**	**1.4 %**
ECA2	73.2 %	21.3 %	1.6 %	0 %	**0.3 %**	**3.7 %**
ECA3	70.6 %	20.6 %	2.6 %	0 %	**0.3 %**	**5.4 %**

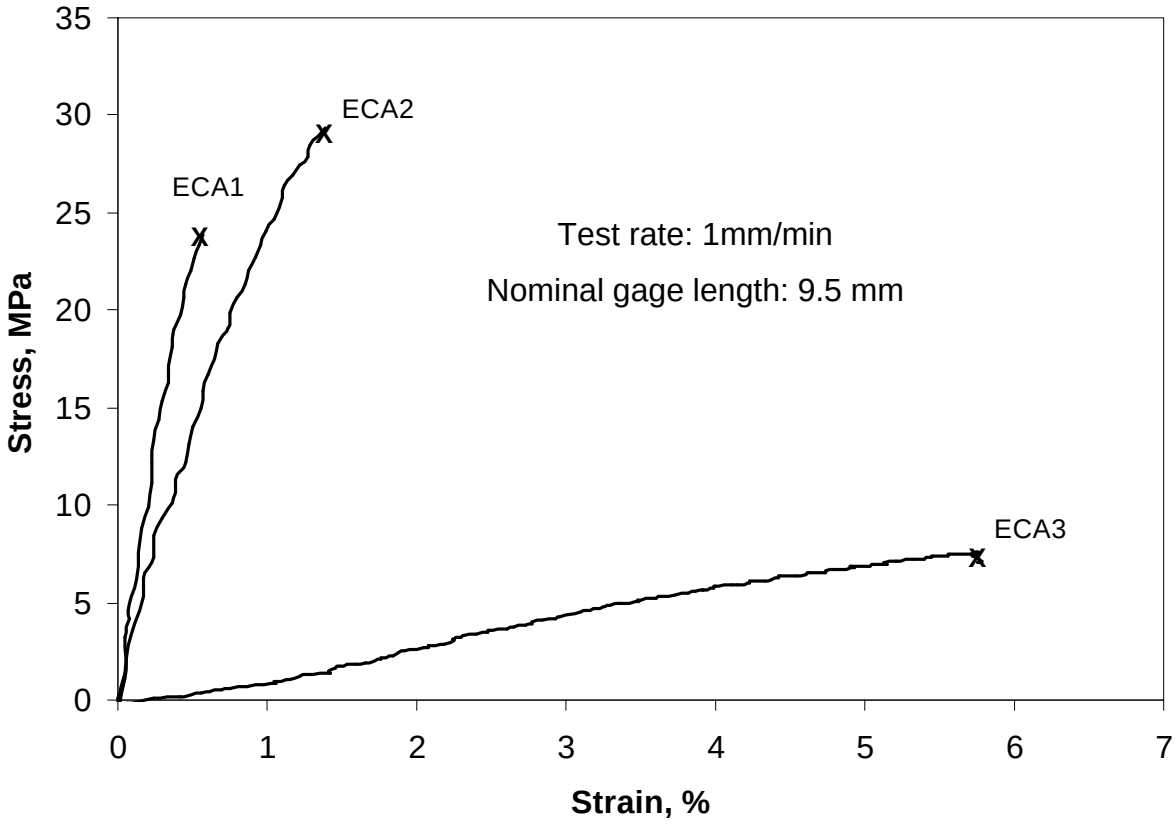


Figure 4. 1 Typical stress-strain behavior of as-produced ECA1, ECA2 and ECA3 samples

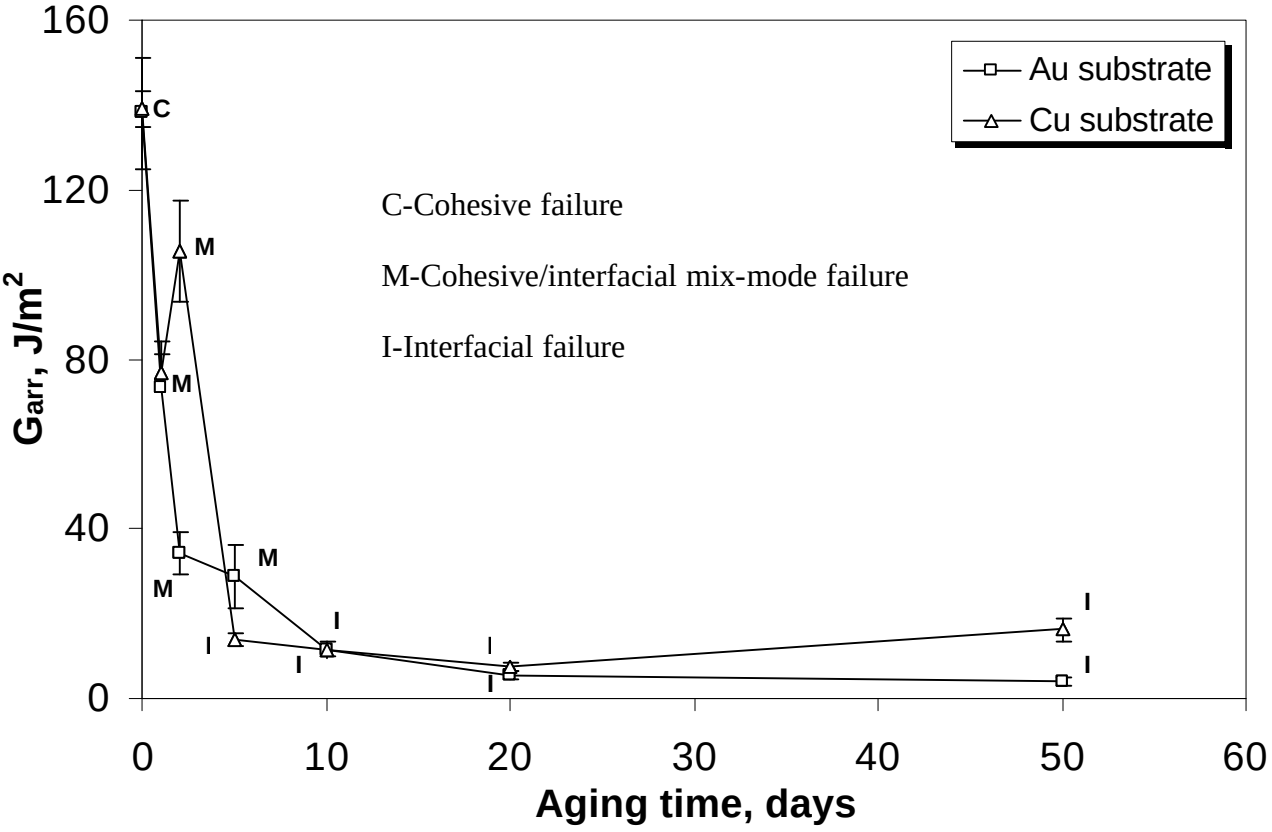


Figure 4. 2 Fracture energy of ECA1–bonded DCB joints as a function of aging time.

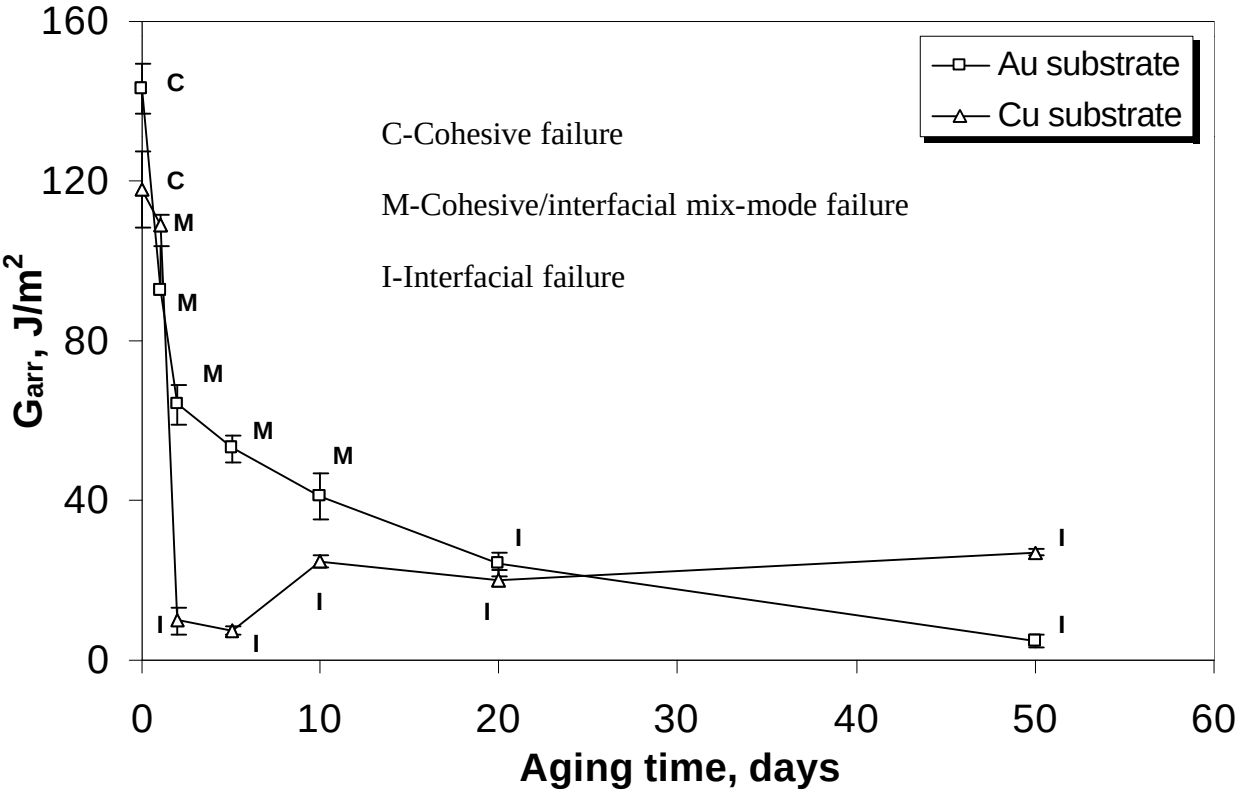


Figure 4. 3 Fracture energy of ECA2–bonded DCB joints as a function of aging time.

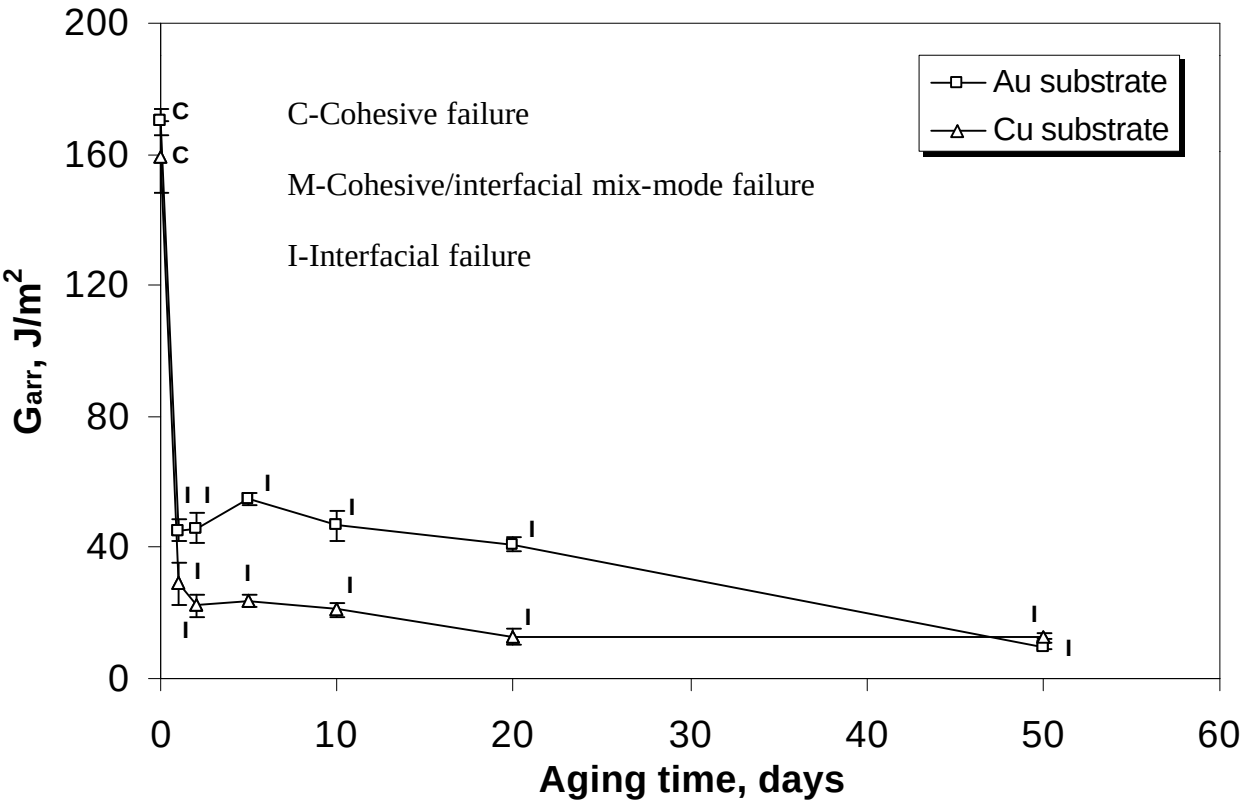


Figure 4. 4 Fracture energy of ECA3-bonded DCB joints as a function of aging time.

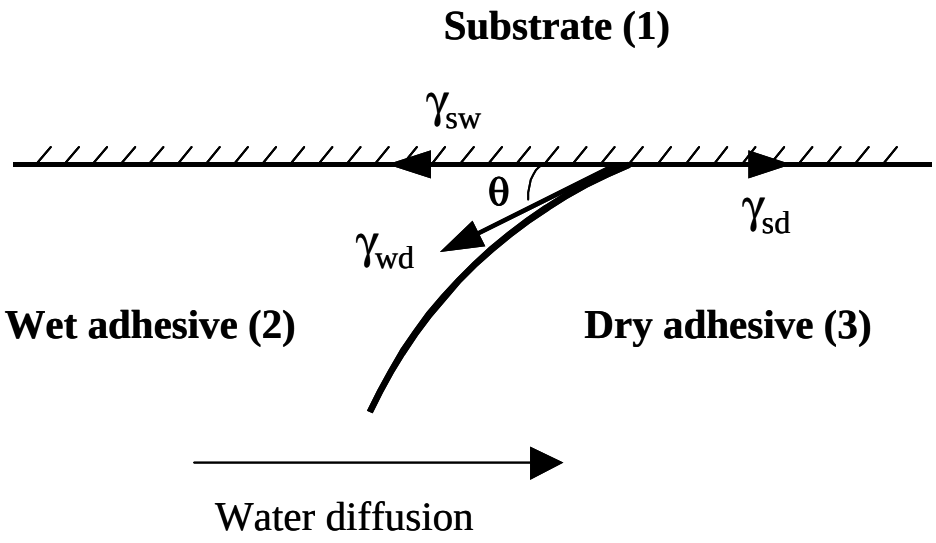


Figure 4. 5 A three-phase diffusion model near the metal/polymer transition after [24].

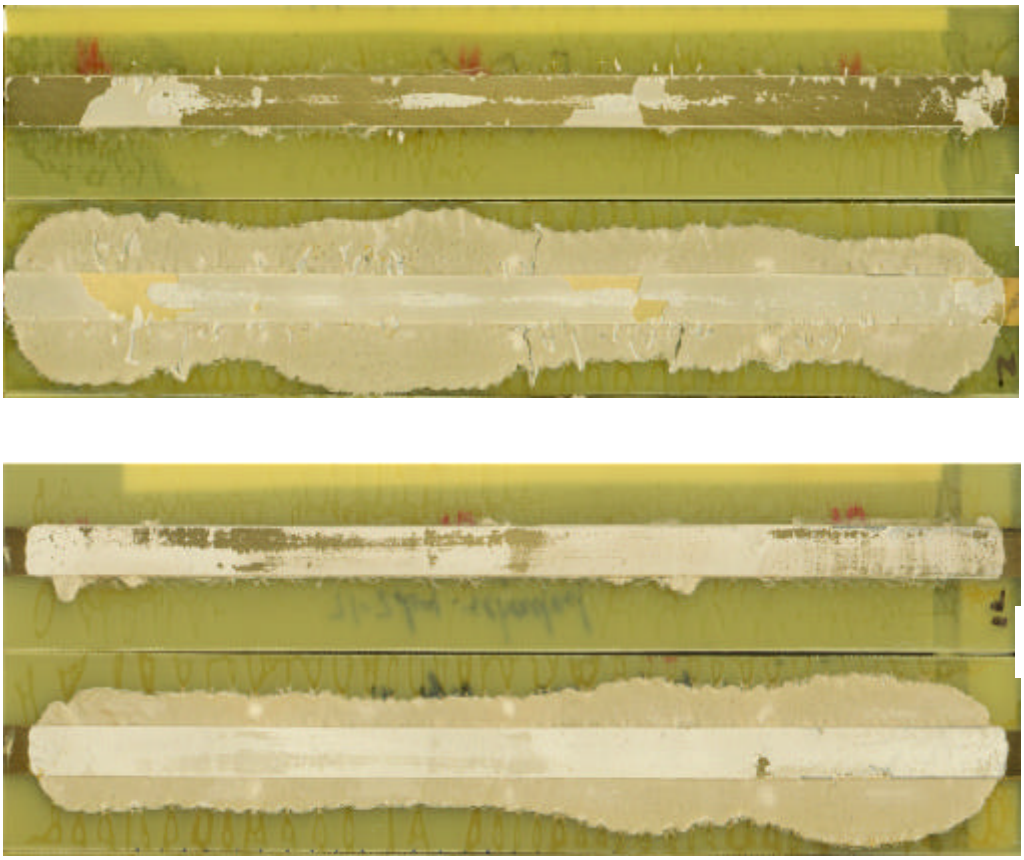
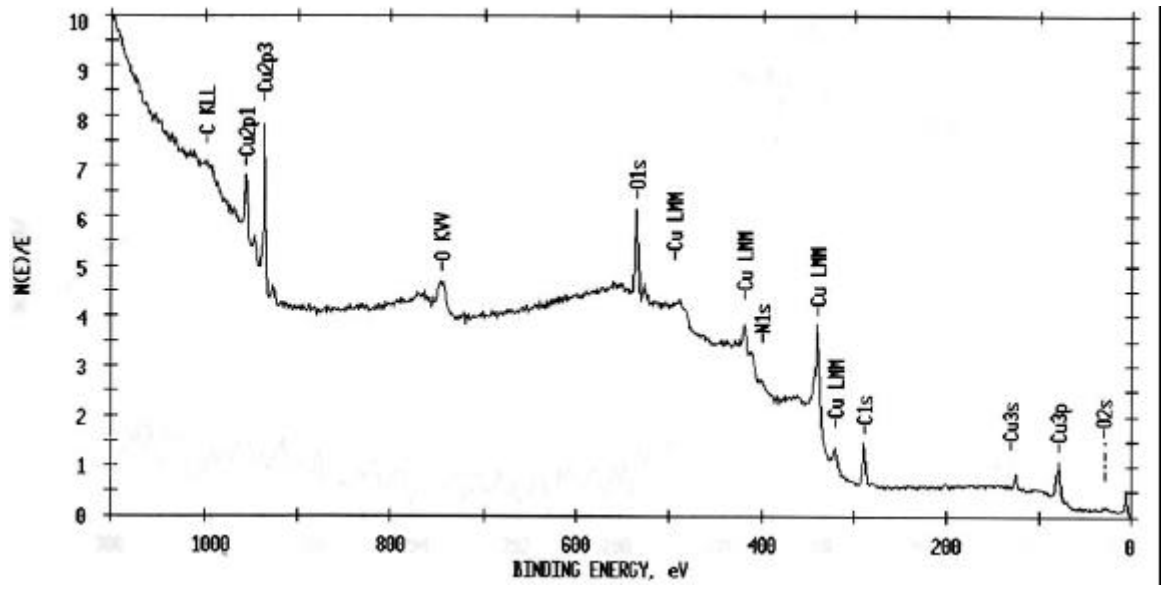
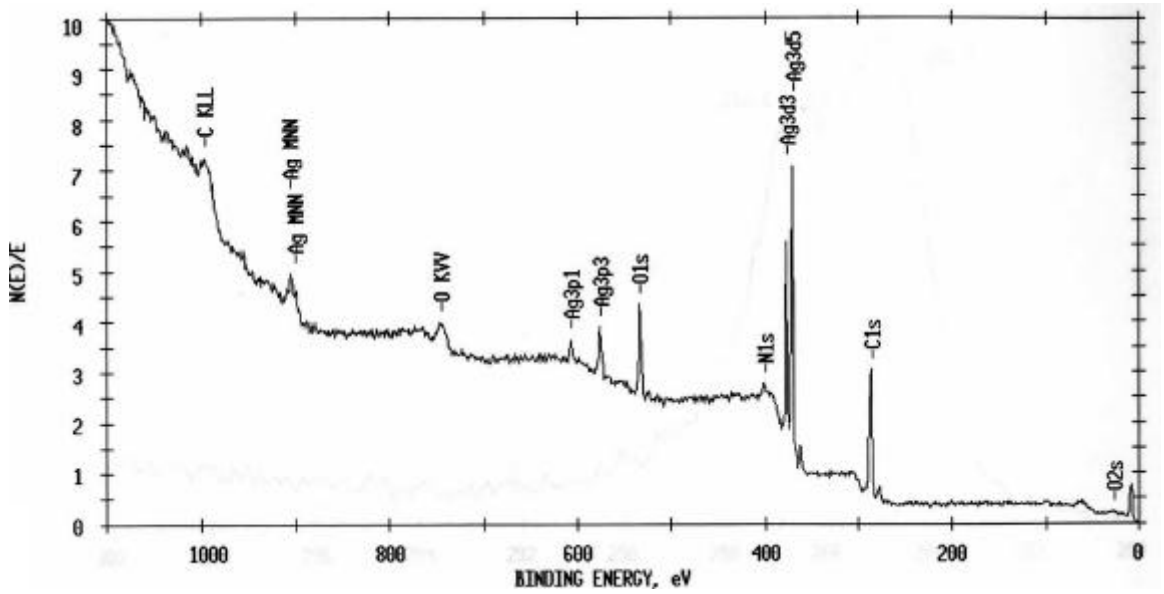


Figure 4. 6 Fracture surface of ECA1 joints after 2 days aging with and without re-drying.



(a)



(b)

Figure 4. 7 XPS spectra of the copper plated substrate prior to bonding (a) and the fractured bulk adhesive (b).

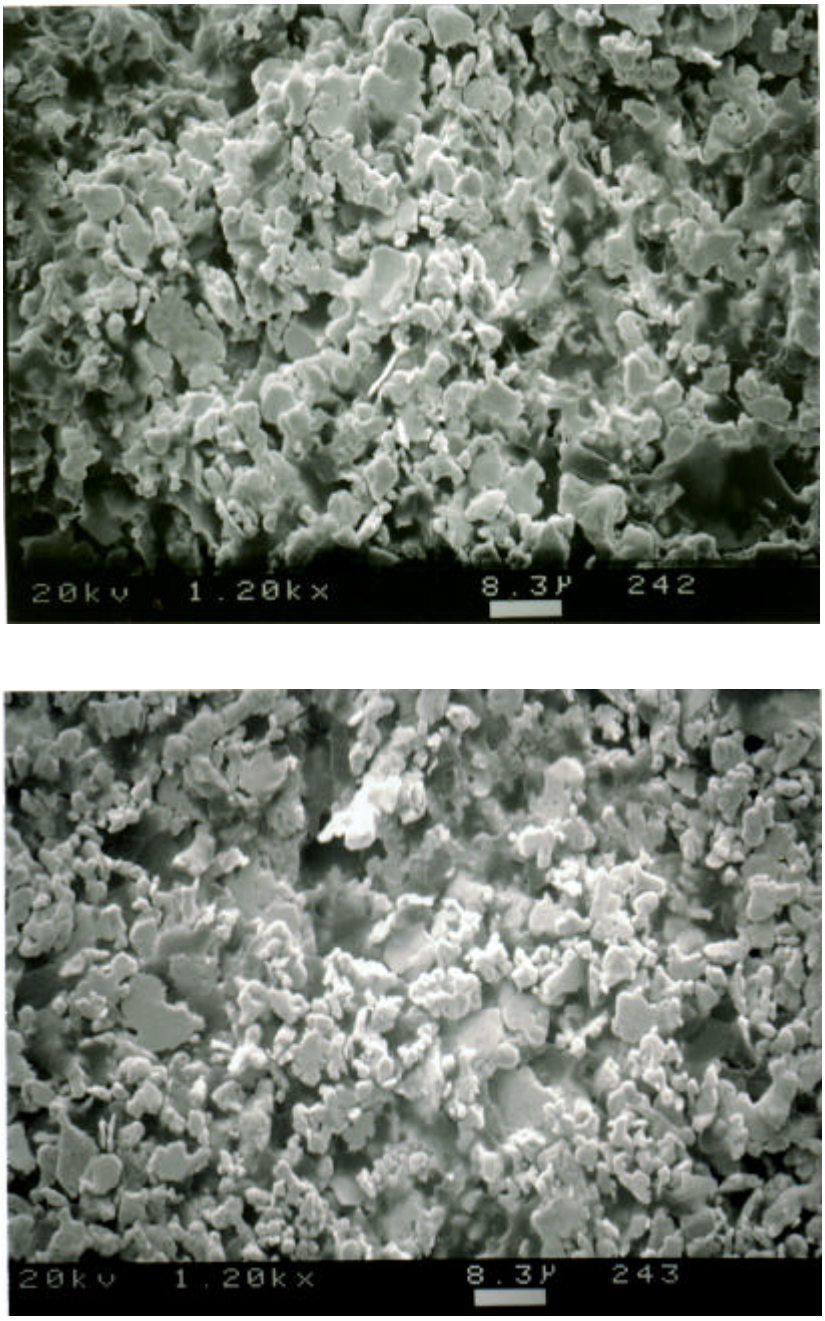


Figure 4. 8 Micrographs of the fracture surfaces of the as-produced ECA2 bonded joint

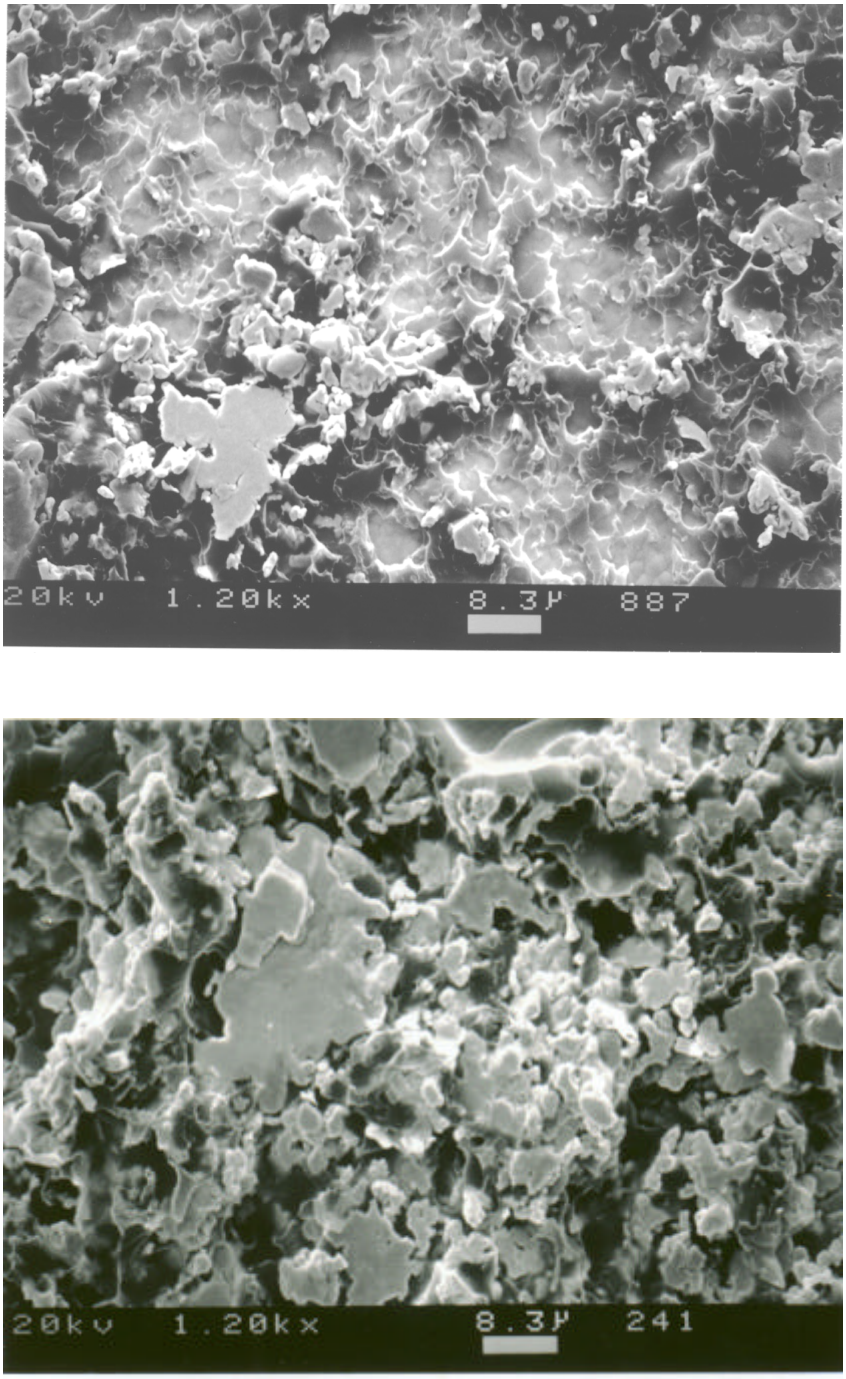
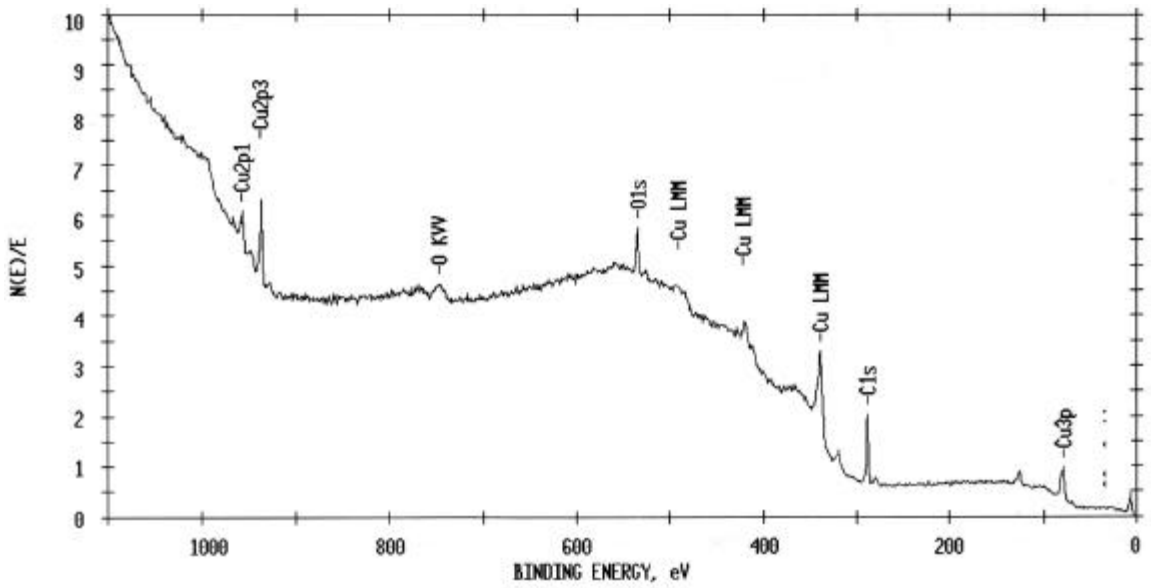
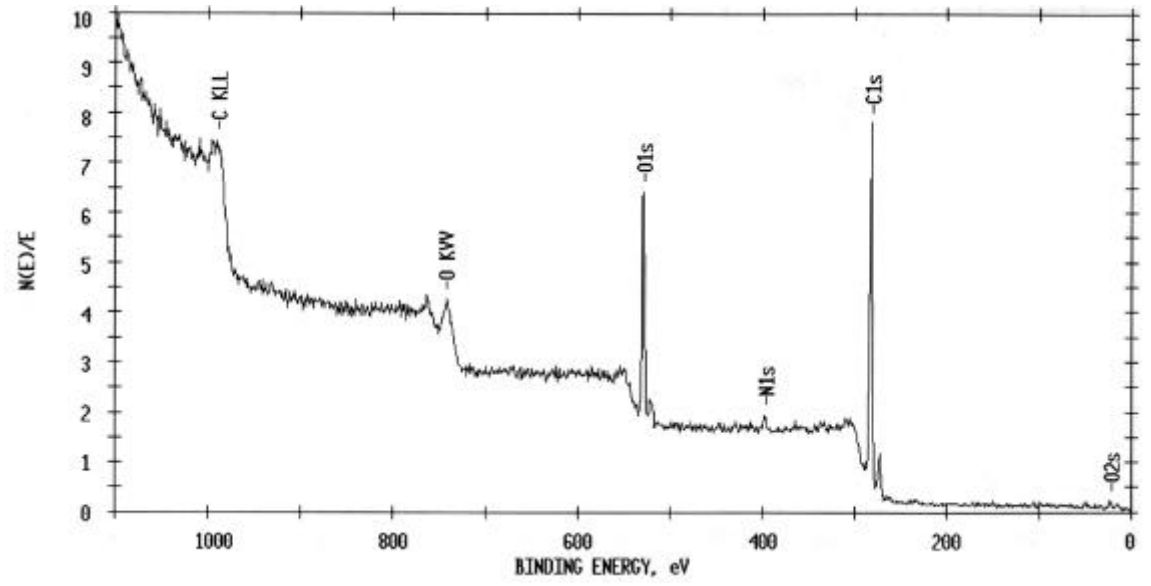


Figure 4. 9 Micrographs of the fracture surfaces of an as-produced ECA3 bonded joint

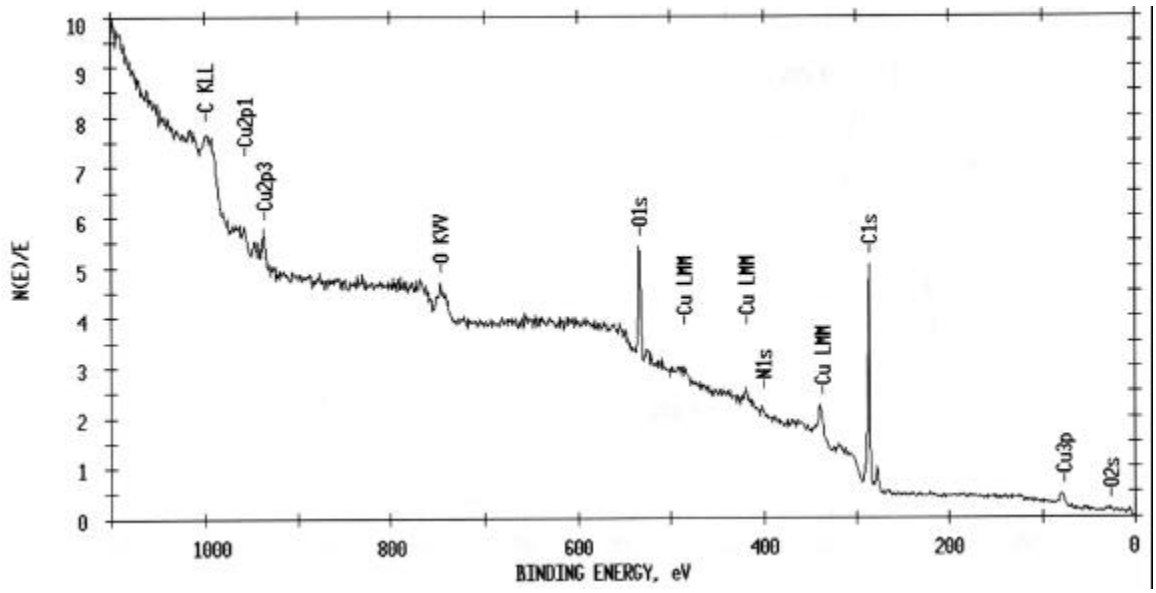


(a)

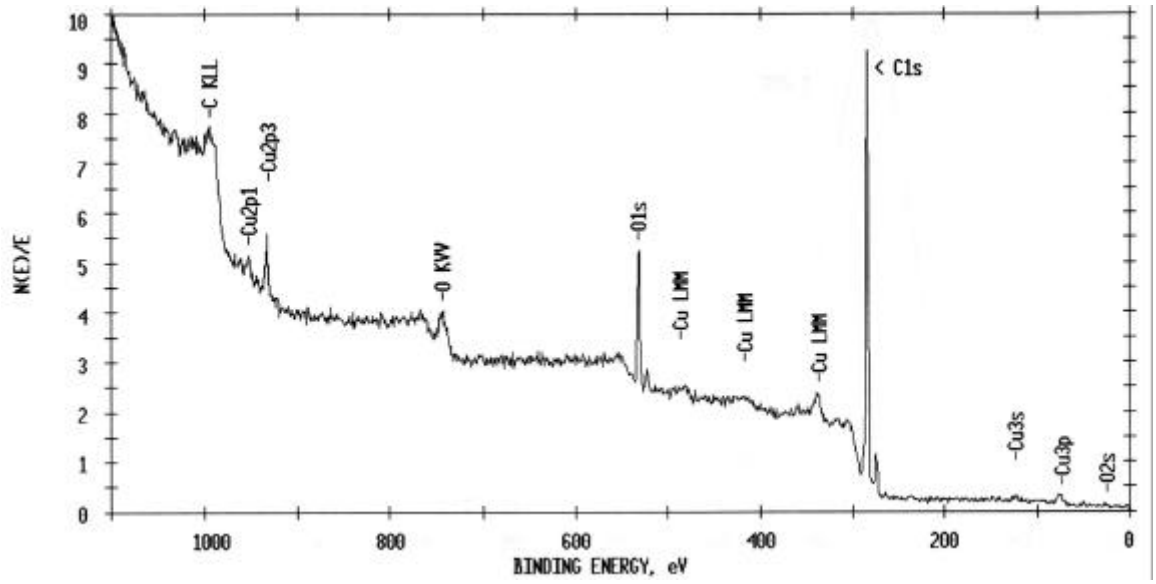


(b)

Figure 4. 10 XPS spectra of the fractured surface of ECA2/Cu joints aged for 2 days. (a) the substrate side; (b) the adhesive side.



(a)



(b)

Figure 4. 11 XPS spectra of the fractured surface of ECA2/Cu joints aged for 50 days. (a) the substrate side; (b) the adhesive side.

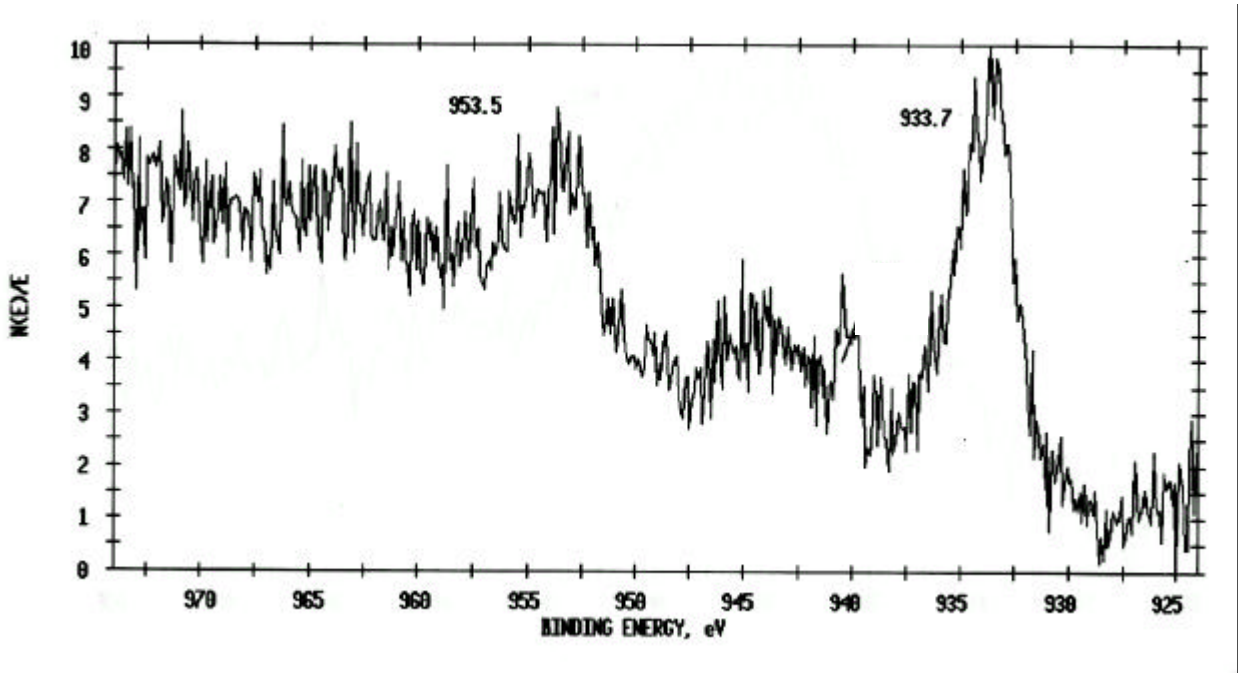


Figure 4. 12 Cu 2p spectrum indicating the formation of CuO on the fracture surface of an ECA2/Cu joint.

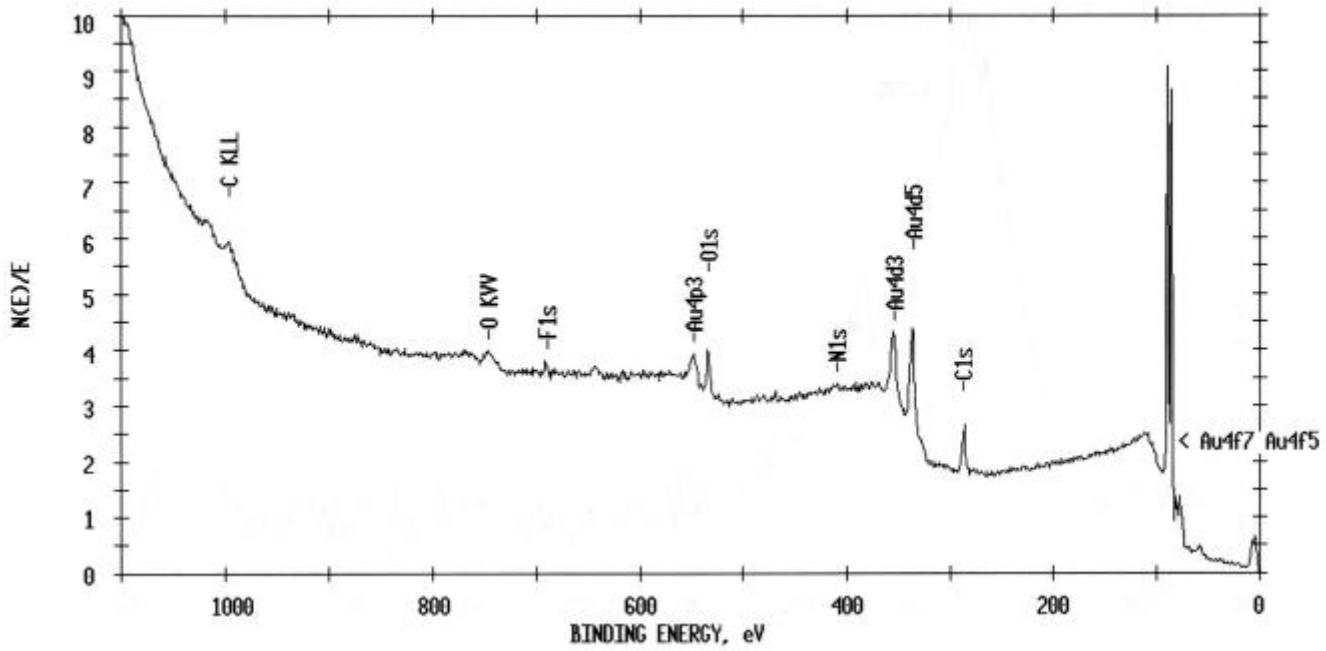
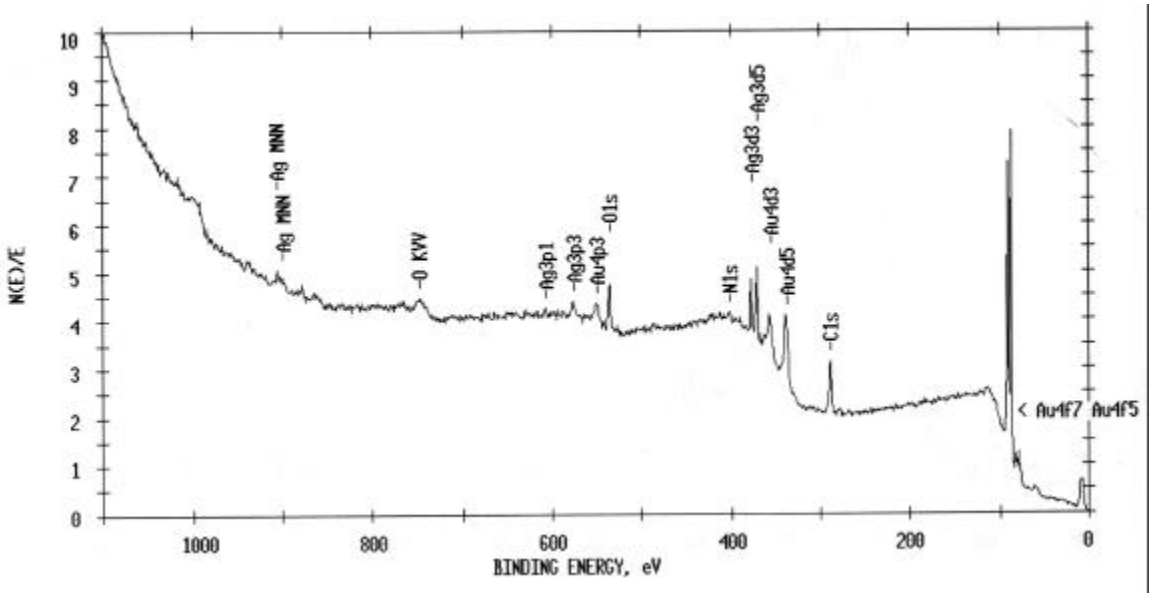
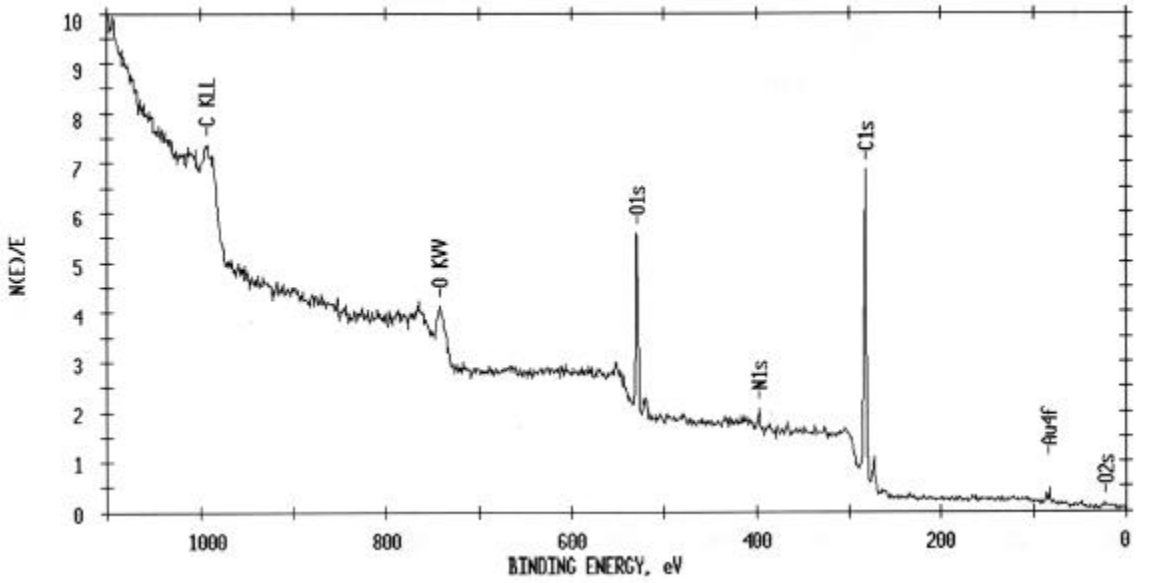


Figure 4. 13 XPS spectra of the gold plated substrate prior to bonding.

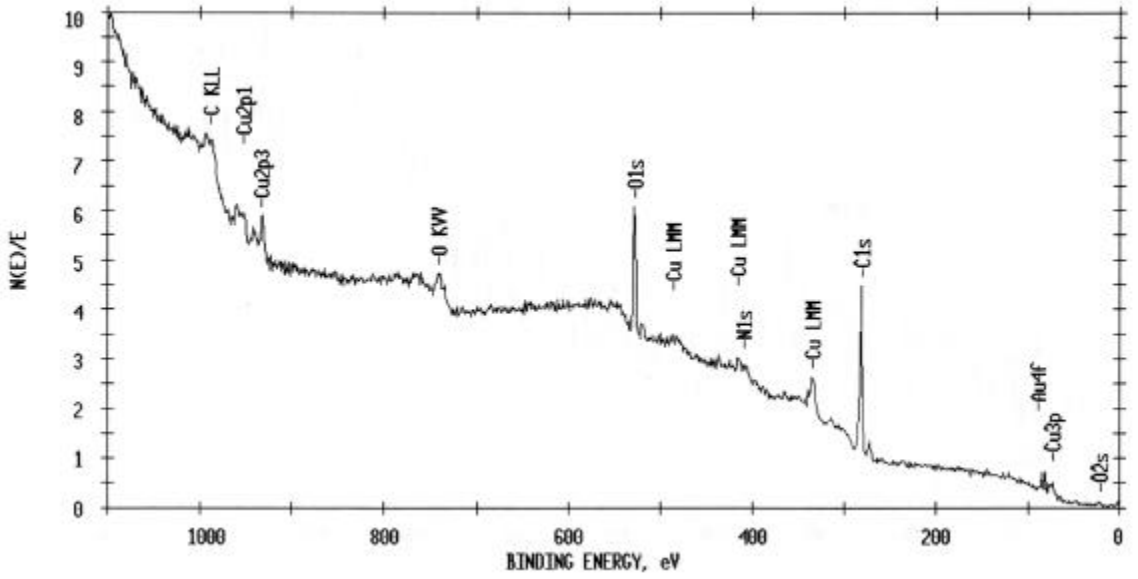


(a)

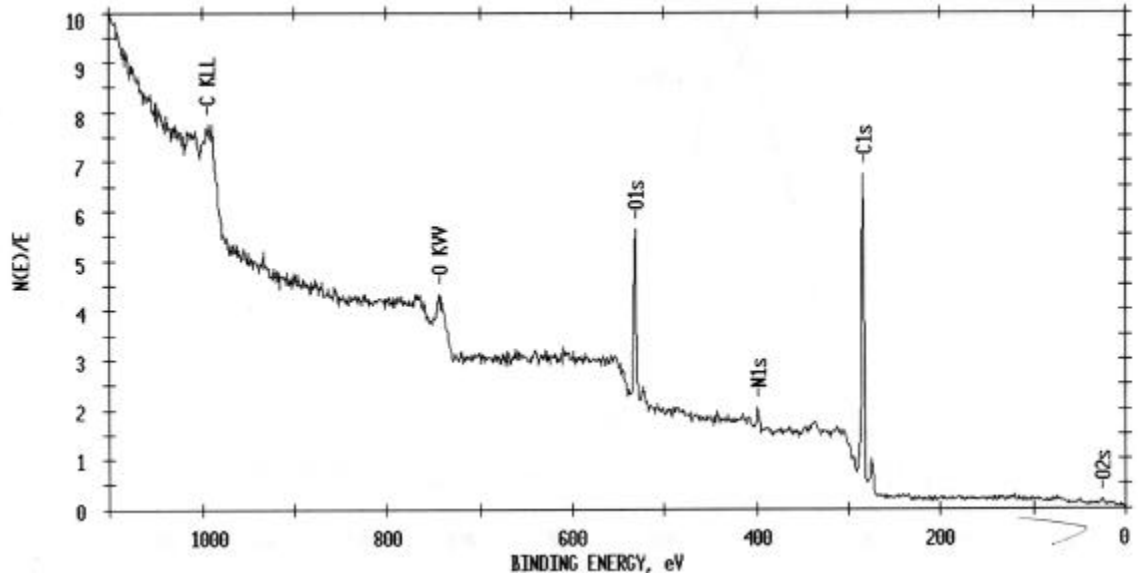


(b)

Figure 4. 14 XPS spectra of the fractured surface of ECA2/Au joints aged for 2 days. (a) the substrate side; (b) the adhesive side



(a)



(b)

Figure 4. 15 XPS spectra of the fractured surface of ECA2/Au joints aged for 50 days. (a) the substrate side; (b) the adhesive side.