3.1 Introduction

This chapter discusses the approaches followed in conducting this research. The details of procedure, experimental plan and conditions for the experiments run as well as equipment's used including characterization methods are described in this chapter. This includes sample preparations, experimental set-up, mechanical testing methods and biocompatibility testing procedure.

3.2 Research Approach

In this research, the ultimate aim is to develop a cheaper yet effective method to coat hydroxyapatite (HA) using sol-gel dip coating technique and to improve the
HA bonding strength on the Co-Cr-Mo alloy by creating oxide interlayer at the sample surface. At the end of this research, bioactivity performances of HA coated samples with oxide interlayer were evaluated through in-vitro test such as metal ions release test and cell attachment responses. These tests were conducted to simulate its real applications as implant materials. Figure 3.1 summarizes the overall experiment flow whilst Figure 3.2 shows the details of experimental works.

**1. Sample Preparations**
- Cut Co-Cr-Mo alloy into small discs
- Anneal cut discs
- Pickle annealed discs to remove oxide scales
- Prepare samples with identical surface by grinding & polishing

**2. Preliminary Experiments**
- Thermal oxidation process at three different temperatures with constant time
- Deposit HA coating on untreated sample:
  i. To obtain the effective HA slurry mixture
  ii. To determine the effective sintering temperature

**3. Experimental Details**

**Control Variables:**

i. Thermal oxidation (fixed)
   - Temperature : 850°C
   - 1050°C
   - Time : 3 hours

ii. Mixture of HA slurry
   - 1 g of HA powder +
   - 10 ml of ethanol, stir at 600 rpm for 24 hours

iii. Sintering process (fixed)
   - Temperature : 750°C
   - Time : 1 hour

iv. Dip coating parameters (fixed)
   - Immersion speed : 200 mm/min
   - Withdraw speed : 200 mm/min
   - Dipping : 5 times

**Research Outcomes:**

- Formation of oxide interlayer
  i. Surface morphology
  ii. Thickness of oxide interlayer
  iii. Compound of oxide interlayer
- Adhesion strength of oxide interlayer
- Adhesion strength of HA coating
- Biocompatibility assessment:
  i. Metal ions release
  ii. Cell attachment morphologies

**Figure 3.1** Box diagram of the overall experimental research methodology.
Figure 3.2 The overall flow chart of experimental works.